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VIEWS, NEWS AND INTERVIEWS.

"I secured a contract recently to install an electric light plant in a brewery," said a Providence contractor. "The man I put in charge of the work was about six feet tall and as fat as a match. He worked around the brewery six weeks and gained 26 pounds in weight."

In view of the decision in the famous Bate case, which practically throws open to the world the manufacture of incandescent lamps, it may be interesting to note some of the decisions rendered which declared Thomas A. Edison to be the inventor of that useful appliance. In 1884, the German Patent Court declared Mr. Edison's patent fundamental. In 1886, the High Court of Justice, England, held that Mr. Edison's patent was valid and granted injunction against infringers. In 1887, the Court of Appeal, England, confirmed the decision of the High Court of Justice and continued the injunction. In July, 1891, Judge Wallace, of the United States Circuit Court, in granting an injunction against infringers, said that Mr. Edison "made a lamp which was practically operative and successful, the embryo of the best lamps now in commercial use." On October 4, 1892, the United States Circuit Court of Appeals confirmed the decision of Judge Wallace.

All trains on the Chesapeake and Ohio Railroad are now lighted by storage batteries. The charging station is located at Richmond, Va., and the batteries have a capacity of 60 hours.

Farmer Dunn, the weather prophet of New York city, now has electric lights on top of his eyrie in the tower of the Manhattan Insurance Company's new building, to assist him in disseminating weather signals. There is a 20,000 candle-power red light to indicate high easterly winds and to warn sailors to keep their weather eyes open for cyclones and hurricanes. On top of this there is a white light six feet high and five feet in diameter, and when both are lighted all persons are admonished to look out for high winds from the West. Below, on a little trolley road which encircles the tower, is a great revolving searchlight, to attract attention to the signal lights, except when it is thrown through a green glass. Then it will indicate a cold wave.

During the Cleveland electric light convention Mr. Fred. Gilbert, the well-known electric light magnate of Boston, occupied with two friends a very elegant and luxurious suite of rooms at the Hollenden. A friend happened to call on Mr. Gilbert about three o'clock one morning and was surprised to find him sitting in a big arm chair smoking and reading.

"Hello! Do you know what time it is?" inquired the friend. "I should think you'd be in bed and asleep."

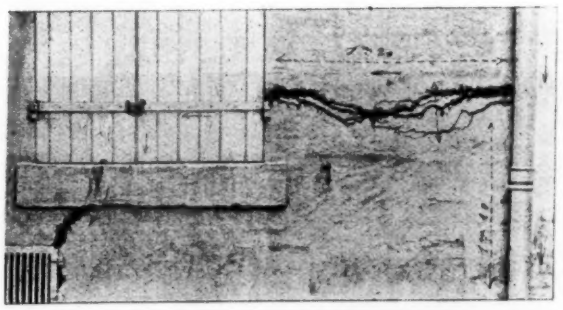
"Asleep? Why, man," replied Mr. Gilbert, "I can't afford to sleep in these rooms. They cost me $16 a day and sleep at two dollars an hour is a little too expensive for yours truly."

M. Moissan has recently succeeded in preparing pure titanium by means of the electric furnace. The metal proves to be the most refractory of any he has yet dealt with, being less fusible than pure chromium, tungsten, molybdenum, uranium, or zirconium. It is an extremely hard metal, capable of scratching the diamond. It is, however, soluble in lead, copper and iron.

The importance of the electric-lighted buoys in Gedney Channel, New York Harbor, was shown last week when the ice rendered them useless, and the steamer "Havel," being unable to keep the channel, ran aground on Romer's shoal.

The Pennsylvania Railroad, it is said, has decided to invite bids from electrical companies for trolleying the Burlington branch of the Amboy division. This branch is about eight miles long, running from Burlington to Mount Holly.

The record for speed in the sending of telegrams is said to be held by the Commercial Cable Company. In September, 1894, a message was sent from Manchester, England, to Victoria, British Columbia, and the answer returned, all in 90 seconds. In October a message was dispatched from New York to London, and the answer received in five seconds.



TRACES LEFT BY LIGHTNING ON A HOUSE AT NIORT, FRANCE.

American Institute of Electrical Engineers.

Considerable interest is being shown in the annual election for president of the American Institute of Electrical Engineers, which occurs in June. It is understood that the choice will probably lie between Dr. Louis Duncan, of Johns Hopkins University, Baltimore, and Prof. Francis B. Crocker, of the Crocker-Wheeler Electric Company, New York city.

LIGHTNING PAINTED BY ITSELF.

HOW LIGHTNING BEHAVES IN FRANCE.

The vagaries of lightning strokes are proverbial and the illustration on this page, for which we are indebted to the *Literary Digest*, shows a curious phenomenon which occurred in France. The traces left by this flash were unusually clear. The occurrence was described as follows in *Cosmos:*

On this date—July 22, 1894—a series of thunderstorms occurred in the west of France, in Belgium, and even in Holland. About 11 o'clock at night one of these was raging over the city of Niort, when a violent clap of thunder was heard, and the lightning struck the house No. 60 Avenue de Paris. The electric fluid first struck the chimney, then, descending along the roof, it tore off and threw to the ground a great number of tiles. This done, it reached the water-pipe and followed it till within about five feet of ground. At this point the phenomenon changed all at once; the electrical discharge left the pipe, jumped across to the iron hinge of a window-shutter, reached the fastenings, on which there are traces of fusion, and then descended to the grating that protected a cellar window.

To make its path incontestable it left its trace on the wall, which had been recently painted a yellowish white. The next day it was seen that the track of the electricity over the paint had turned brown, as the photograph shows.

We are, then, in the presence of a positive and undeniable record. It remains to explain the facts.

M. Sieur, professor at the College of Niort, to whose courtesy we owe this interesting photograph, thinks that the fluid, finding in the water-pipe an insufficient outlet to the ground, divided, and that one part directed itself toward the hinges of the shutter in order to reach the ground by the cellar. This explanation, though it seems very natural, is not, in our opinion, the most probable. The grating, the hinges and the fastenings of the shutter form a mass of metal large enough to assume by induction a high electric potential. The difference of potential between the hinge and the water-pipe at the moment of the lightning stroke would have been sufficient to overcome the resistance of the intervening space;

the positive and negative electricities united across this space producing a discharge. It is, in fact, very remarkable that the design of the spark, as the photograph shows it, changes in character about the middle of the surface of masonry.

At the right the lightning is very much divided, and its different threads diverge sufficiently to occupy a breadth of about 20 centimetres (about seven inches). At the left, on the contrary, the bundle is compressed; the maximum spread is scarcely 10 centimetres, and that it must be remarked that in all this part of its path, as far as the ground, the spark is condensed.

Whether our explanation be true or not, the fact is very interesting, and it is fortunate for science that there was found on the spot an intelligent man, thanks to whom specialists have an accurate record to study.

Lectures on Electro-Chemistry at Johns Hopkins University.

There has been started at the Johns Hopkins University, Baltimore, an addition to the present electrical course, consisting of lectures and laboratory work on electro-chemistry. The work is being done by Mr. H. C. Jones, Ph.D., who has had a thorough training in this country and abroad under Ostwald. The course consists briefly of:

1. A historical sketch of electro-chemistry, including theories on electrolysis. 2. Electrical energy. 3. Discussion of the laws of Faraday. 4. The wanderings of ions. 5. Conductivity methods and results. 6. Properties of ions. 7. Electro-motive force. 8. Polarization. 9. Electrolysis. 10. Electro-chemical analysis. 11. Electro-metallurgy.

There will be laboratory work in electrolysis and electro-metallurgy, and in such experiments as conductivity methods, etc. This course will be elective this year. It is attended by 50 students, of whom 27 are electrical engineers, nine physicists, and 14 chemists.

Niagara Falls as an Industrial Center.

The natural advantages of the city of Niagara Falls, N. Y., alone give it an importance as a future industrial center, but with the added benefits of almost unlimited water-power and the electric service of the Niagara Falls Power Company the development of the city and its surrounding territory promises to be extremely rapid and of a stable character. Real estate values in this vicinity have advanced considerably during the past two years, and the population of the adjacent territory is increasing day by day. Manufacturing establishments are realizing the benefits to be derived from locating their factories at or near the Falls, and already the building for the largest aluminum works in the world has been completed.

The accompanying illustrations, for which we are indebted to Mr. S. S. Kingsley, of Buffalo, N. Y., show some characteristic features of interest at Niagara Falls in connection with the development of electric power. Fig. 1 is an interior view of the Niagara Falls Power Company's great tunnel. It is 7,000 feet long, 19 feet wide, 21 feet high and is lined with 15,000,000 bricks. In Fig. 2 is shown a view of the same company's subway for carrying their electric power transmission lines throughout their properties in the south and eastern portions of the city of Niagara Falls. One of the Cliff Paper Mills 1,200 horse-power water wheels is shown in Fig. 3. The Hydraulic Power Company furnishes the power for this wheel, which is located at the base of the Cliff. A sectional elevation of the Niagara Falls Power Company's power house No. 1 is given in Fig. 4. The equipment, when the installation is completed, will consist of ten 5,000 horse-power generators driven by turbines from vertical shafts.

FIG. 1.—INTERIOR VIEW OF THE NIAGARA FALLS POWER COMPANY'S GREAT TUNNEL.

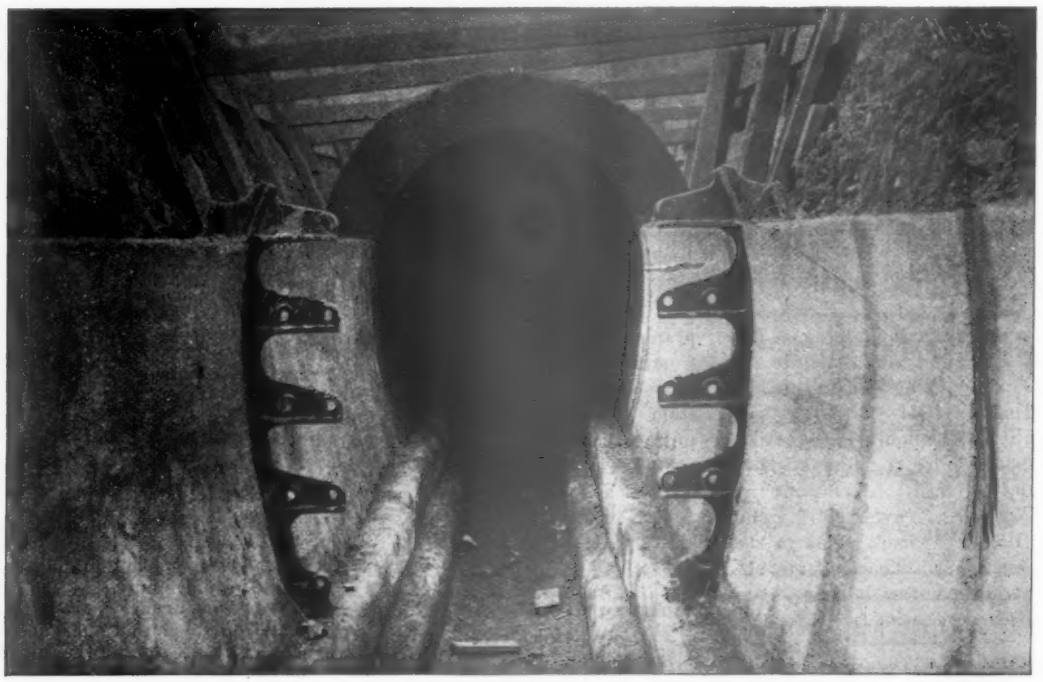


FIG. 2.—VIEW OF THE NIAGARA FALLS POWER COMPANY'S SUBWAY FOR ELECTRIC TRANSMISSION LINES.

George Westinghouse, Jr., in speaking of the prospective growth of Niagara Falls, is quoted as saying:

When manufacturers locate there you will be astonished at the rapidity with which they will multiply. Half a dozen factories will attract a half dozen more; that dozen will beget another dozen and they will go on increasing in geometrical proportion. Your locality possesses all the advantages of transportation facilities and is advantageously centrally located as a distributing point for the whole country, and from what I know of electricity and of its possibilities when generated by the water-power you have there, I expect to see a city at Niagara Falls which will astonish the world with rapidity of its growth.

An Important Long-Distance Transmission Project.

The Susquehanna River Electric Power Company, it is rumored, has purchased the plant of the Susquehanna Water Power and Paper Company at Conowingo, Md., for $600,000, and expects to commence work building a dam across the river as soon as the Spring floods permit. It is said that Mr. Rockefeller, of the Standard Oil Company, is interested in the enterprise, and the plant will be one of the largest of its kind in the world. It will supply Philadelphia, Wilmington, Del., and Baltimore with light and power.

A Red-Eyed Circular.

The "*Wounded Bird*" has issued a brand-new red-tinted circular for waste basket consumption, on the back page of which appears its own picture with the sad inscription that it doesn't get time to sleep any more. There is a noticeable cessation of circulation prevarication and appeals to advertisers to discontinue with contemporaries that betokens a momentary return of sanity, the result, no doubt, of dear experience.

LETTERS OF KINDNESS.

WHAT THE FRIENDS OF THE "REVIEW" HAVE TO SAY.

IT CONTAINED A CHECK.

To the Editor of Electrical Review:

Presume you know I couldn't get along without the Electrical Review.

L. H. Korty.

Omaha, Neb., March 2, 1895.

"A VALUABLE REPOSITORY," SAYS COL. KING.

To the Editor of Electrical Review:

We have been taking the Electrical Review regularly for several years past in the Engineers' School library, and consider it a valuable repository of electrical literature.

W. R. King.

U. S. Engineers' School, Willett's Point, March 2, 1895.

A FLUTTER IN BOSTON.

An extract from a Boston letter of Wednesday, March 6, from an observing electrical reader, says:

"I might here remark that there is the wildest kind of a flutter among the representatives of your contemporaries here over the Electrical Review supplement and the advertising it contains. I am told they have been doing the hardest kind of 'hustling' all day in an effort to secure the same business for their next issues, but without success. Your last issue was great."

A CHICAGO VIEW OF THE "WOUNDED BIRD'S" CATECHISM TO ELECTRIC RAILWAY MEN.

To the Editor of Electrical Review:

The issue of the Electrical Review of February 20 was full of meat as usual. That proclamation of the Grand Inquisitor which you published beats the record. Is this American journalism? What a blessed *naïvete* these questions manifest. The whole catechism reminds one of the five-cent novel lover's standard questions addressed to or delivered before the heroine, *i. e.*:

"Dearest, do you love me truly, and if so state why, wherefore, and how I may improve myself in your eyes to be worthy of your love?"

In one word: It is painful to witness the simmering idiocy of a public-favor hunter whose every motion is in the direction of a *faux pas*, and must finally result in a ridiculous but utter collapse.

S. G.

Chicago, Ill., February 23, 1895.

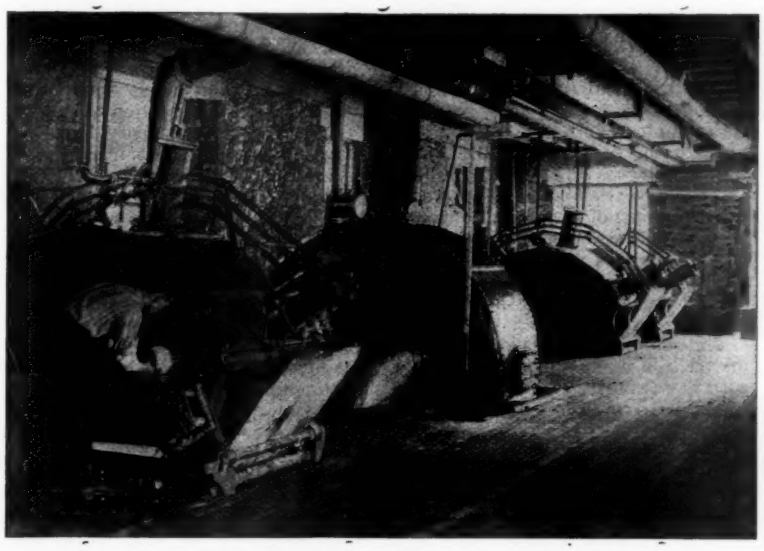


Fig. 3.—A 1,200 Horse-Power Water Wheel at the Cliff Paper Mill, Niagara Falls.

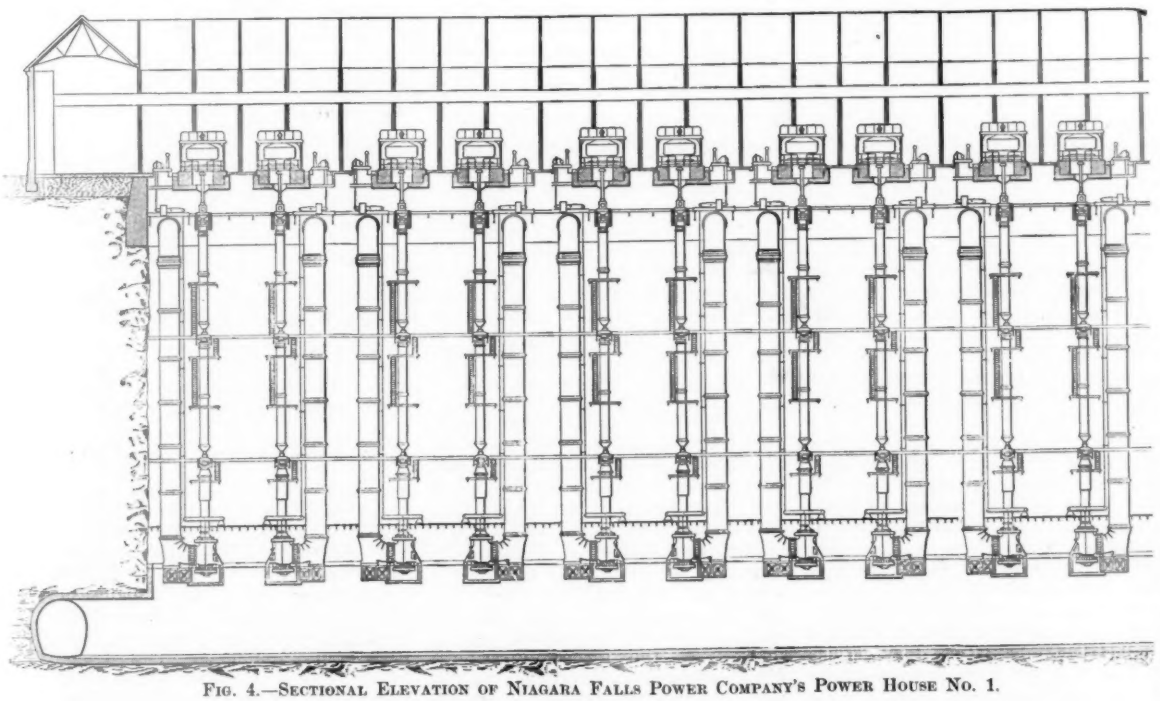


Fig. 4.—Sectional Elevation of Niagara Falls Power Company's Power House No. 1.

"GROWING IN FAVOR."

To the Editor of Electrical Review:

It is a source of pleasure to me to watch the steady progress of the Electrical Review. No one can deny that the journal is growing in favor among the great reading class of persons interested in electrical matters.

G. B. Vertrend.

Boston, Mass., February 22.

Handsome Cars in Columbus.

The cars used by the Columbus Central Railway Company, of Columbus, Ohio, are unusually handsome. The interior finish, doors, frames, etc., are solid mahogany with white and gold ceilings, which help the illumination wonderfully. Within reach of every passenger is an electric push button, which signals for the conductor, and is found to be a great boon to the patrons, especially when a car is crowded and the conductor cannot be seen directly. All glass throughout the car, even in the ventilators, is heavy plate glass, and the view through it is of course undistorted. The middle on each side is formed as a blind panel, with the company's monogram outside and a beveled plate glass mirror inside. The entire door framing at each end is made removable, so that when warm weather comes the doors can be entirely removed, an arch substituted, and thus the entire front left open to the Summer breeze. At the same time storm curtains are available on wet days in Summer. The cars are heated with electric "risers," which have the gratings flush, so that passengers' legs are not roasted in the operation of heating the car.

TELEPHONE NEWS AND COMMENT.

General Manager Hanford says the Harrison Telephone Company will have an exchange in Chicago, and service will cost the public about $60 per year.

The Tucker Electrical Manufacturing Company, of New York city, manufacturers of a telephone system, have been sued by the Western Electric Company for alleged infringement of the Scribner factory telephone system patents.

The annual report of the Hudson River Telephone Company for the fiscal year ending December 31, 1894, shows gross revenue, $260,978, increase, $11,148. Net revenue, $82,121, increase, $19,517. The company has capital stock of $2,000,000 and surplus of $29,990.

The Wadsworth, Ohio, General Electric Company and the Wadsworth Electric Company have consolidated under the name and charter of the first. The erection of a telephone exchange and an electric light plant will be the first work of the new company. Capital, $10,000.

Prof. Lucien I. Blake, of the chair of physics and electrical engineering at the Kansas State University, made a successful test recently of a system he has been working on for a long time to establish telephone communication between lightships and the land. His plan, in brief, is to lay a supplementary chain from the anchor chain, a sufficient distance away from the ship so that the ends lying on the bottom of the ocean will be relieved of the swinging and strains of the ship lying at anchor. To this supplementary chain is attached a submarine cable connecting the ship with the shore.

The annual meeting of the New York and New Jersey Telephone Company was held in Brooklyn, N. Y., recently. The following officers were elected: President, Charles F. Cutler; vice-president and general manager, W. D. Sargent; secretary, Joel C. Clark; treasurer, Henry Sanger Snow; executive committee, Charles F. Cutler, Joseph P. Davis, W. D. Sargent and Joel C. Clark; directors, Charles F. Cutler, Alexander Cameron, Morris F. Tyler, Joseph P. Davis, Charles A. Nichols, Hugh Kinnard, William D. Sargent, David B. Powell, Geo. H. Prentiss, Joel C. Clark, Felix Cambell and Edward J. Hall. The treasurer's report showed the gross earnings to have been $1,252,508.83; the operating expenses, $804,566.89; the fixed charges, $103,027.91; net earnings for this year, $344,914.50. Surplus, December 31, 1894, $837,569.44. In the president's report he says: "A lot has been purchased on Greene avenue, near Broadway, for the erection of a branch office, to be known as Bushwick. It is in contemplation to open four additional offices in Brooklyn at convenient localities."

ARC CARBONS AND THE RATING OF ARC LAMPS.

READ BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, CLEVELAND, FEBRUARY, 1895, BY L. B. MARKS.

At the last convention of the National Electric Light Association a Special Committee on the Rating of Arc Lamps submitted a report, which was adopted and ordered printed in full in the Standard Rules of the association. The report reads as follows:

Recognizing the difficulty, if not impossibility, of measuring with any degree of accuracy the illuminating power of the arc lamp, and the great necessity for a more precise definition and statement of the obligation of the producer of electricity for illuminating purposes to the consumer thereof, be it

Resolved, That in the opinion of this convention what is ordinarily known as a 2,000 candle-power arc lamp is one requiring on the average 450 watts for its maintenance, measurements being made at the lamp terminals, where no sensible resistance is included in series with the arc; in case such resistance is used it must be excluded in the measurements of the voltage.

This resolution naturally suggests the inquiry as to how far the candle-power produced depends upon the watts consumed; in the present paper attention will be confined to the part played by the arc carbon in this important relation.

It is, of course, well known that the so-called 2,000 candle-power arc really gives a mean candle-power of only 300 to 600, the candle-power at the angle of maximum illumination seldom being greater than 1,200, and often as low as 700. In an elaborate series of comparative tests made by the writer* several years ago, there was found to be a variation of over 80 per cent in the candle-power of commercial arc light carbons consuming the same energy. Quite recently Professor W. M. Stine† has reported on a number of tests, the results of which show a variation of about 30 per cent.

The difference in the quality of arc carbons is well brought out in the table herewith, in which values are given for the hissing point, and the flaming point of various American and foreign products, respectively.

In order to determine these values, a pair of carbons was placed in a lamp and burned for 20 or 30 minutes. After the point had been well formed, the carbons were gently brought together until the arc hissed. A voltmeter connected to the terminals gave the potential difference. The lamp was then adjusted for a silent arc and the mechanism so arranged that the rod was held rigidly. The carbons were then allowed to burn away until they flamed, the voltmeter being carefully watched meanwhile. Before the flaming point was reached the instrument would invariably fluctuate, due to "jumping" of the arc. At the flaming point there was a marked drop in the potential, as indicated by a voltmeter. Great care was taken to secure perfect alignment of the upper and lower carbons.

The results given in the table are an average of three different tests of each pair of carbons. The carbons were all intended for a current of from eight to 10 amperes, nine and one-half amperes being used in the tests. The total length of a pair of carbons was 10 inches in each case.

It will be noted from the table that the range, that is, the difference in volts between the hissing point and the flaming point, varies greatly with different carbons; thus, while carbon No. 4 (see table) has a range of only 11.4 volts, carbon No. 3 has a range of 34 volts. Both of these carbons are sold by representative American manufacturers, the former being a squirted petroleum coke carbon and the latter a molded coke carbon. The hissing point of the cored carbon averages over 10 volts lower than the solid. The hissing point of the American cored carbons (Nos. 15 and 16) does not vary much from that of foreign (Nos. 17, 18, 19), but the range of the latter is fully 10 volts greater than that of the former, and exceeds that of any of the American products tested, cored and solid. In the case of some makes of cored carbons not recorded here, it was impossible to measure the hissing point with any degree of accuracy, because of the deposition on the negative of small portions of the core thrown out by the positive at low potential differences. Carbons Nos. 11, 17, 18 and 19 in table are of foreign manufacture, all the others being home products.

The amount and nature of foreign matter in a carbon have much to do with the commercial efficiency of the latter, and determine to a large extent the range of the carbon.

Number.	Structure.	Diameter (Inches).	Basic Material.	Process of Manufacture.	Hissing Point. (Volts.)	Flaming Point. (Volts.)	Range. (Volts.)
1	Solid.	1/6	Petroleum Coke.	Molded.	43.6	71.3	27.7
2	"	1/8	"	"	48.2	79.0	30.8
3	"	7/32	"	"	45.7	79.7	34.0
4	"	1/8	"	Squirted.	51.3	62.7	11.4
5	"	1/6	"	"	47.3	75.0	27.7
6	"	1/8	Lamp Black.	"	47.2	70.8	23.6
7	"	7/32	"	Molded.	43.0	67.3	24.3
8	"	1/8	"	Squirted.	43.7	76.8	33.1
9	"	1/8	Gas Black.	"	46.	70.7	24.7
10	"	1/8	"	Molded.	41.3	74.3	33.0
11	"	1/8	Not Ascertained.	Squirted.	41.7	75.3	33.6
12	"	1/8	Pure Coke.	Molded.	53.7	73.7	20.0
13	"	1/8	"	"	52.0	71.5	19.5
14	(+), 1/8 hole. (−), solid.	1/6	Petroleum Coke.	Squirted.	42.8	60.7	17.9
15	(+), cored. (−), solid.	(+), 7/32 (−), 1/8	"	"	35.0	61.7	26.7
16	(+), cored. (−), solid.	1/6	"	"	31.3	58.7	27.4
17	(+), cored. (−), solid.	(+), 1/6 (−), 1/8	Not Ascertained.	"	31.3	70.7	39.4
18	(+), cored (−), solid.	7/8	"	"	32.3	66.3	34.0
19	(+), cored. (−), solid.	(+), 1/6 (−), 1/8	"	"	31.7	71.3	39.6

Table showing the hissing and flaming points, respectively, for mean current, 9.5 amperes. Measurements by Wm. C. Hubbard.

It has been the desire of central station men to obtain, and the aim of the manufacturer to produce, an absolutely pure petroleum coke carbon, thinking that this would, in a large measure, solve the candle-power question so far as uniformity is concerned. The writer is of the opinion, however, that an absolutely pure coke carbon, if such could be commercially manufactured for arc lamps, would not meet the requirements of central station practice to-day. Carbons 12 and 13 (see table) are taken from two batches made with special reference to purity. It will be noticed that one of them hissed at 53.7 volts, and the other at 52.

To be operated at maximum efficiency, these carbons would require more than 55 volts at normal current and under no conditions in practice would they give satisfactory service at less than 55 volts average—fully five volts higher than that of good commercial carbons. In connection with the potential difference required for maximum candle-power in a given case, it is interesting to refer to a test reported by Professor H. S. Carhart, in which a pair of commercial carbons designed for use on full arc circuits showed a maximum efficiency at about 55 volts. These carbons at 10 amperes and 45 volts gave 450 candle-power.

Thus, it is of the utmost importance to the carbon manufacturer to test not only the range of his carbons, but also the voltage at which they give maximum efficiency. The importance of steadiness in arc lamps has been very well shown by the introduction of cored carbons. Here, again, we are confronted with the question of candle-power in relation to the consumption of energy. If we assume that a 450-watt arc gives nominally 500 candle-power with efficient solid carbon sticks, we must make an allowance of at least from 15 to 20 per cent for reduction in candle-power for the same energy substituting an efficient cored carbon stick. Yet, for indoor illumination, the consumer is better satisfied with the cored carbon than with the solid.

Reference has already been made to current density. It would be entirely out of the question to designate a given current density for commercial light carbons, yet, in attempting to formulate a relation between candle-power and energy expended in the lamp, the question of current density must necessarily be considered.

Schreihage* deduced the law that, for homogeneous carbons of the same make, the candle-power varies inversely as the diameter. He states that this relation, as is to be expected, is not completely satisfied in the case of the mean horizontal candle-power, especially when the carbons are very small or very large.

When we consider that as a means for securing long life, flat carbons and "twin" carbons have been more or less used, we are reminded that in connection with the available candle-power per watt expended in the arc lamp, the shape of the carbon must be given due consideration.

A consideration of alternating current arcs opens up another field in the discussion of candle-power, wherein the carbon point plays an important part. In the commercial operation of alternating current arcs, cored carbons are almost exclusively used. The constituency of the core has much to do with the efficiency of this type.

The comparison of the candle-power of a commercial alternating current arc with that of a direct current arc consuming the same energy, as measured at the carbon points, shows that the former gives less illumination than the latter. So important is the relation of the carbon point to efficiency of the alternating current arc that the substitution of a solid carbon for a cored carbon in this form may reduce the candle-power and decrease the efficiency to such an extent as to make the lamp unmarketable.

Thus far we have discussed arcs which burn with free access of oxygen. In the case of inclosed arcs, or those which are operated in small bulbs, to which the air has very limited access, the conditions that govern the relation of watts to candle-power for the open air arc are more or less modified. With inclosed arcs, purity of the carbon is very important, and in some applications of these arcs the objections which stand in the way of commercial utilization of pure carbon electrodes in open air arcs do not apply.

The importance of details in the manufacture of carbons cannot be overestimated in the consideration of this subject. With the carbon maker rests the task of supplying a uniform and efficient product; but even with the best carbon product it would seem advisable to discard the term "2,000 candle-power" or "1,200 candle-power" as applied to arc lamps.

Measurement of the wattage, provided for in the resolution of the Committee on the Rating of Arc Lamps, appears to be the true solution of the problem. The central station manager will undoubtedly find it to his interest to furnish good carbons, and if he demands them the carbon manufacturer will supply them. To quote Captain William Brophy, "The sooner you sell your light as power, the sooner this trouble will end; and I advise every man in the future to sell his lamp at 450 watts, or whatever is necessary, and bury out of sight the term '2,000 candle-power.'"

* L. B. Marks, "Life and Efficiency of Arc Light Carbons." Transactions American Electrical Engineers, Vol. VII, Nos. 6 and 7, 1890.

† M. W. Stine, "Influence of Arc Light Carbons on the Candle-Power." New York *Electrical Engineer*, Oct. 3, 1894. See, also, *Electrical World*, Feb. 23, 1895.

* M. Schreihage, *Centralblatt für Electrotechnik*, Nov. 22, 1888.

A Powerful Transmitter.

The new granular carbon transmitter of the National Telephone Manufacturing Company, of Boston, patented December 11, 1894, is attracting the attention of leading telephone and telegraph experts. The superintendents of telegraph of two of our largest railroad corporations have pronounced it the most powerful transmitter that has ever come under their observation.

This instrument combines the sensitiveness of a Blake with the power of a Bell "solid back" and can be used on lines of one-half a mile or over one thousand miles, according to the number of cells of battery connected—six cells of battery having been used without breaking it. This feature alone recommends the instrument for talking over wires that are supported on poles carrying powerful current wires of electric light or street car companies, its great power enabling it to talk through the induction. This transmitter will also be in demand for use in connection with submarine cables, police and fire alarm telegraph lines, etc.

An authority on telephones writes as follows:

"The great trouble with telephone interests to-day arises from the fact that outside of the Bell company there are very few who can appreciate a modern telephone representing the highest state of the art. Many so-called experts are more at home with a microphone or dust transmitter which is simply a cast-off of many years ago of the American Bell company. Already many telephone corporations or exchanges have gained costly wisdom from bitter experience, having hurriedly introduced telephones illy fitted to withstand the demands made by the public at this time, for a fair priced but efficient service."

The National company has already sold nearly 500 of its new instruments to supplant those above referred to. The successful men of the coming generation are those who will be educated to understand and utilize a modern telephone.

New Armature Cutting Presses.

The requirements of armature work for electric motors and dynamos have led to the construction of presses which differ in essential points from those used for other styles of sheet metal work.

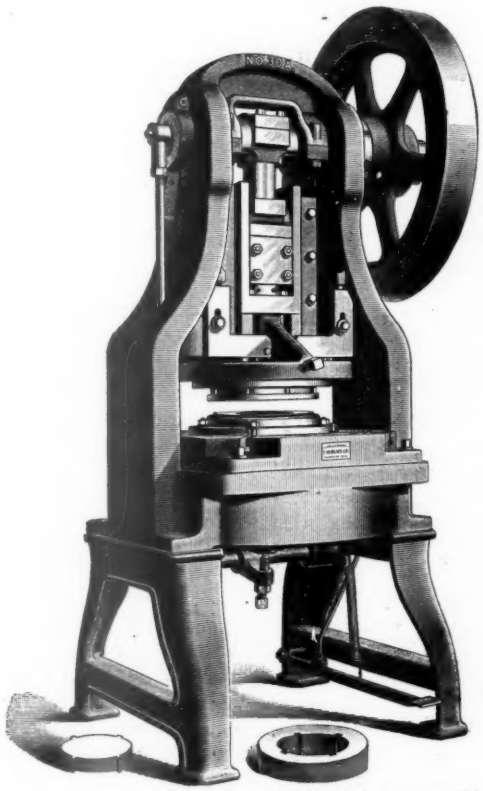
The usual form of armature is made up of annular disks with notches on the outside or inside circumferences. As it is essential to have the outside and inside exactly concentric, it has been found best to adopt dies which, by cutting them simultaneously, eliminate the inaccuracies which are almost unavoidable when the cutting is done in two or more operations. In most cases, the notches and key slots are also punched at the same time, all of which calls for tools having "throw-out pads," in addition to the cutting parts, so as to automatically push the disks and scrap out of the disks and punches.

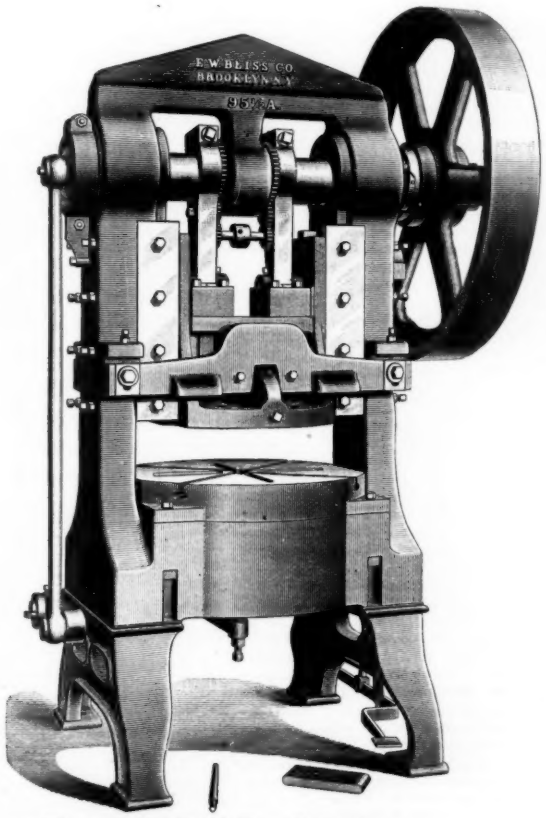
These "throw-out pads" are now usually operated by means of heavy springs, which are not only far from reliable, but consume a great deal of the power of the press. The two presses shown herewith are designed to operate these "throw-outs" in a positive manner, and consume but little of the power of the press. It will be seen that, in addition to the usual slide carrying the punch, there is a bottom slide, actuated by an outside crank connection and which operates the dies and "throw-out pads" through radial slots in the bolster.

Two cross-pieces, adjustably attached to the frame of the press, actuate the "throw-out pads" of the punches by striking against them on the return motion of the main slide.

The press shown in Fig. 1 is more particularly designed for cutting simultaneously the inside and outside of plain rings, with or without key notches, such as are shown on the floor in the illustration. These presses will do up to about 20 inches in diameter of this class of work. These rings or disks are then subsequently notched in a notching machine.

The press shown in Fig. 2, on the other hand, is most frequently used for cutting the whole disk, including all the notches, at one blow, and can be used for that class of work up to 11 or 12 inches in diameter. Beyond that size this press is usually furnished with back gearing and sometimes with a body casting of steel instead of cast-iron. It can, however, be also used for plain rings, and, in that case, is designed to take in diameters up to 24 or 30 inches. It is also a useful machine for cutting the smaller sections for armatures of large generators, in which case the outside of the sections and the holes in same are mostly punches simultaneously. The illustrations show two of a series of similar machines, made by the E. W. Bliss company, Brooklyn, N. Y., who will furnish particulars concerning these and all other sizes.





FIGS. 1 AND 2.—NEW ARMATURE CUTTING PRESSES MADE BY THE E. W. BLISS COMPANY.

Death of Royal E. House.

Royal Earl House, who died at Bridgeport, Conn., on February 23, was one of the earliest electrical inventors of the present century, and while a young man invented a printing telegraph system. He was born at Rockingham, Va., September 9, 1814, and therefore was in his eighty-first year when he died. He made many inventions, including a threaded glass insulator and the machine for forming it, which is in use to-day. He achieved a signal victory in 1849 over the owners of the Morse patents, who alleged that his printing telegraph instrument infringed their patents.

Great Demand for Platinum.

Since the rendering of the decision in the Bate case, which threw open the manufacture of incandescent lamps, a considerable number of new lamp factories have opened or are about to open. In consequence there has sprung up an unusual demand for platinum for leading-in wires. The platinum house of Baker & Company, of Newark, N. J., report that they are far behind in their orders for the metal and are working their force over-time in the endeavor to keep pace with the demand.

Electricity is Dutiable.

Comptroller of Canadian Customs Wallace has decided that electricity comes under the head of unenumerated articles, and consequently bears a duty of 20 per cent. The question arose over a proposition to transmit power from the American side of Niagara Falls to surrounding Canadian cities.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

[*Issued by the National Carbon Company.*]

APRIL, 1895.

Day of Mo.	Light.	Day of Mo.	Extinguish.	No. of Hours.
	H.M.		H.M.	H.M.
1	P. M. 11.20			
2		2	A. M. 4.40	5.20
3	A. M. 1.20	3	" 4.40	3.20
4	" 2.00	4	" 4.40	2.40
5	" 2.40	5	" 4.40	2.00
6	" 3.00	6	" 4.40	1.40
7	No light.	7	No light.	
8	No light.	8	No light.	
9	No light.	9	No light.	
10	P. M. 7.00	10	P. M. 9.20	2.20
11	" 7.00	11	" 10.30	3.30
12	" 7.00	12	" 11.40	4.40
13	" 7.00	14	A. M. 1.00	6.00
14	" 7.10	15	" 1.40	6.30
15	" 7.10	16	" 2.30	7.20
16	" 7.10	17	" 3.00	7.50
17	" 7.10	18	" 3.30	8.20
18	" 7.10	19	" 4.00	8.50
19	" 7.10	20	" 4.20	10.10
20	" 7.10	21	" 4.20	10.10
21	" 7.10	22	" 4.10	10.00
22	" 7.20	23	" 4.10	9.50
23	" 7.20	24	" 4.10	9.50
24	" 7.20	25	" 4.10	9.50
25	" 7.20	26	" 4.10	9.50
26	" 8.00	27	" 4.00	8.00
27	" 9.10	28	" 4.00	6.50
28	" 10.20	29	" 4.00	5.40
29	" 11.00	30	" 4.00	5.00
30	" 11.20	May 1.	" 4.00	4.40
	Total			170.10

A NEW METHOD OF MEASURING ILLUMINATION.

READ BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, CLEVELAND, FEBRUARY, 1895, BY EDWIN J. HOUSTON AND A. E. KENNELLY.

In almost all cases the object of artificial lighting is to provide a sufficient intensity of illumination upon the illumined surfaces. In practice, the illumination is generally required so as to permit some kind of work to be carried on. In any case, the character and intensity of the illumination will necessarily vary with the nature of the work. In a room in which reading only is to be done, it suffices if the proper illumination is obtained on the pages of the books; *i. e.*, on the reading tables, though the remainder of the room is comparatively dark. Where machinery is to be operated, the main light is generally required upon certain moving parts. In cases, however, where the character of the work requires the attendant to move about, or to observe some distant part of the machinery, a necessity exists for avoiding marked contrasts in the illumination of the room. Here it is clear that the use of a single source, such as an arc lamp, is undesirable, since, apart from the fact that it would produce a powerful illumination in its immediate neighborhood, it would necessarily cause annoying shadows which could only be avoided by diffusing and scattering the light. It is evident, therefore, that in practice it is the illumination, rather than the luminous intensity of the sources, which is desired to be obtained and measured.

Although experience will enable the electrical engineer to determine the probable number and grouping of sources of light, such as incandescent lamps, which will be required to produce any desired illumination in any given space, yet it is well known that no rigid rule can be laid down as a safe guide in such cases, since the character and color of the surfaces of the walls and ceiling will largely influence the illumination produced by a given arrangement of light sources. The question, therefore, as to whether or not a certain area is properly lighted cannot be decided so accurately from the number and grouping of luminous sources and their candle-power as it can from a method of actually measuring the quantity of light received per unit of area by a particular surface or surfaces whose illumination it is desired to know. In other words, the question at issue is not so much the photometric intensity of the sources of light and their distribution as it is the degree of illumination actually produced, and this question cannot be decided by the photometer, but requires the use of an illumination measurer or illuminometer.

Suppose, for example, it is desired to illumine a billiard room. Though experience must determine the number and position of the lamps, yet the commercial question as to whether or not the necessary illumination has been obtained upon the tables can best be determined, not by the number of separate lamps of a given candle-power, but by an actual measurement of the light received per unit of area on the table surfaces. In the same way whether or not a certain grouping of lights over the tables is sufficient to illumine the rest of the room satisfactorily can be determined by the measurement of the illumination produced in different parts of the room. Similarly, in a dining or reading room, it is the illumination of the tables that has to be specially provided for, and the question of proper lighting is best determined from a determination of the illumination of the tables irrespective of the character or number of the lights present, except, of course, in so far as æsthetic requirements are concerned.

In street lighting the requirements are that sufficient illumination be obtained on the surfaces of the streets, houses, vehicles and persons, to be able to discern them clearly at reasonably sufficient distances. This primarily requires a certain intensity of illumination over a given area, and can best be determined from the actual measurement of the minium illumination, rather than by calculations dependent upon a number of complex conditions, of which the photometrical intensity of the sources employed is but one.

Measuring the illumination rather than measuring the intensity of separate lamps would remove a source of great annoyance, both to electrical engineers and to municipalities, by rendering unnecessary discussions as to the candle-power of incandescent or arc lights employed, since, if the contract between the city and the lighting company be so drawn that the illumination in any part of a lighted street, for example, in the absence of moonlight, shall not be less than a certain minimum, all questions as to the candle-power of the separate sources will fail to affect the contract, and it only remains for the electrical engineer to pro-

(*Continued on page 138.*)

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The electric heater must soon give place to the electric fan.

Prof. Thomson's timely communication, which will be found on the opposite page, presents, in a pointed manner, his views on the peculiar state of affairs made apparent by the recent decision in the Bate case.

TELEPHONING TO LIGHTSHIPS.

While we recognize nothing new in the methods employed by Prof. Lucien I. Blake for telephoning between lightships and the shore, yet we congratulate him for having carried the matter nearer to completion than any previous experimenter in this country. Aside from the value of such communication to the weather bureau, the life saving service and other vessels at sea, there is a distinctly commendable advantage to the crews of the ships in being able to feel that they are not utterly cut off from the world. No one who has not lived for days on a lightship anchored in the tossing waters miles from land can appreciate the utter isolation, desolation and loneliness of life aboard a lightship.

To the venturesome visitor who comes aboard, a welcome, almost childlike in its eagerness, is extended, and his departure is witnessed with sincere regret. So that, if Professor Blake has done nothing more than to enable the captain of a lightship to crack a joke with a man in the station on shore, he has done a good turn to a brave and hardy set of men.

Carried to a practical success, Professor Blake's experiment would prove of considerable value in enabling lightships off the Massachusetts coast to report incoming vessels by telephone to the shore and then this report could be telegraphed to New York, giving us such news nearly a day in advance of what we get now.

Electricity is to be known as a tangible product and, generated in the State of New York, is to be taxed when it is carried over the wires into Canada. Just how the "juice" will be measured is not announced. Probably at so much per horse-power for strong currents, but how the quantity used in transmitting telegrams will be taxed is evidently a refinement of calculation not yet attempted.

Why is it petitioners to State legislatures so often know so much that is not so? When they petition these bodies to cut down rates on railroads, palace cars, telephones, etc., the ignorance displayed is actually criminal. If such lack of knowledge of their own affairs exists, the wonder is that they have lived as long as they have. We should think they would have starved to death long ago.

The inventors with electric car fenders are very numerous. The perfect one has yet to be brought to our attention—if it can be made.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

The market for stocks during this week was irregular, of fickle mood and possessed of no definite tendency. The sentimentalists apparently controlled the situation at the beginning. They thought that because the Congress which had been the cause of so much business misery had adjourned better times would be the result. Prices responded to this feeling in the first two days, after which better sense ruled and a reaction followed. In the latter days the bear party made an organized attack, paying particular attention to vulnerable spots, and ended by having gained considerable ground. There has been absolutely no change in underlying conditions and the market of the near future is dependent upon the tricks of professional manipulators.

In electrical stocks, barring the interest shown in General Electric, there was nothing of any moment. Quotations recorded are: Edison Electric Illuminating of New York, 98; 1st mortgage bonds 105 to 105½; North American, 3½ to 3⅝; American Telegraph and Cable, 91.

The celebrated Bate refrigerator decision has been rendered, and telegraph, telephone and electrical apparatus manufacturers, in common with hundreds of other companies operating under patents affected by the decision, are busy reckoning the effect it will have upon their respective lines of business. The Wall Street mind has been led to believe that General Electric will be one of the chief sufferers by reason of the termination of the incandescent lamp patent, which, had the decision been the other way, would have given the company control of that particular device until November, 1897. The importance attached thereto has been magnified by the persistent and successful litigation which the General Electric Company waged to protect the patent. Let us view the matter from the common sense standpoint. At best the patent had something less than three years to run. Even had the company continued to enjoy it during that time it would have been forced as a matter of future self-protection to gradually place its business on a basis where it could meet open competition, and in so doing would lose most of the advantages enjoyed by a monopoly. What the management would have done of its own accord in this one branch of the business has been forced by the 1893 crisis in the company's affairs in all lines; viz., it has reduced its basis of operation to a point at which it can meet all competition. While it will no longer control the incandescent lamp business, it is equally certain that no other interest can. The larger company, by virtue of its ability to operate on a big scale and by reason of a firmly established trade, will certainly have the advantage.

This decision was announced on Monday, March 4. On the last three days of the preceding week it was discounted by the stock market. This naturally gave rise to the query, was

it mere coincidence? Wall Street often pays well for advance information. In fact, the news had been over-discounted, and when it became generally known there was a sharp reaction of the stock towards higher figures. The low point was 25⅞, reached on Monday; the high point that day 27⅜; in later days the quotation has ranged 26 and 27. The 5 per cent debenture bonds have shown considerable weakness, declining from 89¼ to 88 and later rallying to 88½. There was considerable selling, which had every appearance of liquidation. There was no change in the quotations of the preferred stock.

In the year the Commercial Cable Company has spent $2,500,000 on betterments. It called in $400,000 bonds and now has no fixed charges. During 1894 income was $1,773,434, working expenses $762,996 and net earnings $1,010,438. Dividends of $700,000 were paid leaving the surplus $310,438, against $357,747 surplus on last year's operations. The Commercial Cable Company has declared a regular quarterly dividend of 1¾ per cent payable April 1. Books close March 22 and reopen April 1.

The Postal Telegraph Company has called a meeting for March 28 to authorize an issue of $5,000,000 capital stock. The stock is quoted at 60 bid and 63 asked.

On the Boston Exchange Bell Telephone on Monday declined from 191 to 188 on the Bate decision. It subsequently rallied, closing at the opening price of 191. Erie Telephone sold at 49¾ to 50; New England Telephone at 67; Westinghouse securities were considerably stronger. The movement was due to the Bate decision throwing open to the trade the incandescent lamp. BAIN.

New York, March 9, 1894.

Who Makes The "Reynolds" Transmitter?

A telephone company, recently organized in New York State, writes us as follows under date of March 8:

Please inform us where the "Reynolds" transmitter, referred to in your issue of March 6, can be purchased.

Will the manufacturer please hold up his right hand?

Lectures at Columbia College.

Prof. Francis B. Crocker will deliver six lectures on "How Electricity Is Now Being Utilized," on successive Thursday evenings, at 8.15 o'clock, beginning March 21, at Columbia College, New York. No tickets for single lectures will be sold. Course tickets may be procured from the secretary of the president of Columbia College.

Under the title of "Two Years of Democratic Diplomacy," Senator Cushman K. Davis, of Minnesota, contributes a vigorous arraignment of the foreign policy of the present administration to the March number of the *North American Review*.

Prof. Elihu Thomson on the Patent Situation Resulting from the Bate Decision.

TO THE EDITOR OF ELECTRICAL REVIEW:

I herewith send a statement which may emphasize the unjust condition which, by the recent decision of the Supreme Court in the Bate refrigerator case, is kept in existence. However much cause there may be for congratulation that the Supreme Court has not reversed the almost universal decisions of the lower courts on the points at issue, in the opinions of many persons there still remains a great evil to be corrected, and which I have attempted to point out, without enlarging upon it, though the theme admits of it, in the communication sent herewith.

ELIHU THOMSON.

Lynn, Mass., March 9, 1895.

AN UNJUST PATENT STATUTE.

Now that decided attention has been called, by the decision of the Supreme Court of the United States interpreting Revised Statute No. 4887, to the relations existing between patents taken out in the United States and abroad, it occurs to me that it would be interesting to note at this time some of the disadvantages under which the American inventor has labored in the past and under which he still labors, and not only in so far as it concerns the taking out of patents, but also in relation to the publication of new matter, or to the inventor's place in the history of an art.

While the decision of the Supreme Court makes it plain that the wording of the law in relation to the limitation of United States patents by foreign patents is to be taken instead of what would seem to me to have been the evident intent of the original enactment, I wish to point out some of the injustices under which the American inventor has suffered from this law, as it has been and is now interpreted, in comparison with inventors and workers abroad.

An American inventor making application for a patent has been and will still remain under the disadvantage of being required to perfect his United States patent before applying for patents abroad, and in order to secure valid patents abroad he must refrain from publication of any new matter which he may have discovered until such foreign patents have been obtained, as the mere publication nullifies the right to take a patent in most important foreign countries. But, it is practically impossible, as is well known, under our system of patent examinations to control the time of issuance of a patent in the United States, and if the application should become involved in an interference, which is more than apt to occur with inventions of any considerable importance, the issuance of a patent may be tied up for an indefinite period of years. During this period there is every prospect of the same subject matter being worked upon abroad, or the matter becoming published, especially if the invention undergoes development in the United States. The inventor, therefore, if he desires foreign patent protection, must take his foreign patents and stand the shortening of the term of the United States patent; or, if the interference proceedings or other delays last during the life of the shortest foreign patent, he receives a patent which has already expired when it issues, a "still-born" patent, so to speak.

Again, in the race between two interfering inventions, the weaker party finding that he will probably lose the interference in the United States may easily transfer his scene of activity to foreign countries, while the stronger party feeling that he does not wish to ruin his United States interest, at the same time refrains from patenting abroad. In this case the party who is likely to come out ahead here does come out at the last without any foreign patents, while the other party to the interference may come out with several valid foreign patents, but no United States patent.

Now, I do not think it requires any argument to show that the evident intention of the United States law when it was first passed was not to bring about this state of things and so handicap the honest American inventor. Nor is this all. The position of the foreign inventor, under the United States law, has been that he could make his applications in foreign countries whenever he felt like doing so and receive his patents, and, after an indefinite period thereafter, he was at liberty to apply for a United States patent and obtain a patent only limited by the shortest term foreign patent. Prior publication here would not affect his rights. Prior publication does affect the United States inventor's rights abroad. Does not this amount to a discrimination against the United States inventor? And would it not really tend, were there not other favorable influences, to discourage invention here?

But there is still another point which I consider of the greatest importance. Owing to the conditions under the law as it exists, the United States inventor, no matter what the importance of his work may be, is debarred from publishing it until the issuance of his United States patent, which may take a year or two in the Patent Office, unless he is ready to forego some of the years of its life by taking out foreign patents at once after his United States application has been filed. He is, therefore, under restraint as to publication if he wishes to protect his foreign rights at all. And, let us ask, what has been the effect of this condition of affairs? Has it not been that an undue proportion of the history of many new advances, especially in the electric art, has been first published abroad? Has it not been that publications of new material have often been made abroad when in fact the same subject matter had been worked out here, in some cases years before? Does it not result in the credit for new work or the making of history, as it were, in a new art, being accorded in larger measure to workers abroad than would otherwise be the case? Now, suppose that instead of this law having existed at all inventors who had made valuable discoveries or inventions were at liberty to apply for their United States patents, and were equally at liberty to apply for at once and obtain, without prejudice to their United States rights, foreign patents on the same inventions, then they might freely publish at once their work and obtain the credit for it to which they are entitled, and which under the present condition of affairs has often been taken from them on account of the enforced delay of waiting for the issuance of the United States patents before applying for foreign patents. I have known it to be the case, and I have not the slightest doubt that others actively at work in the electric field have had the same experience, that the first entrance into the electrical literature of some new and important advance has been through the foreign publications, when, in fact, the broad subject had been worked over and was known for a long time previously here, but was withheld on account of this unfortunate state of patent laws in this country.

The United States is entitled to take its proper place, not only in the actual work accomplished, but in the literature which naturally accompanies the work, and without such a restraint as now exists. The question arises, how long is the United States worker to be so handicapped, or practically put under a ban, by ill-considered laws? This is a question which I have often asked myself, and the answer to which, I have no doubt, has been sought by many who have experienced the same hardships.

PERSONAL.

Mr. Frank Ridlon of Boston, was among the visitors to New York last week.

Gen. E. S. Greeley has presented to the Boardman Manual Training School, at New Haven, Conn., a considerable quantity of electrical apparatus.

Mr. J. C. Calisch, formerly with the General Electric Company, is now the representative of the Fort Wayne Electric Corporation in northern and western New York, with headquarters at Rochester.

The Citizens' Gas and Electric Light Company is seeking to enjoin the city of Jacksonville, Fla., from doing a commercial electric lighting business on the ground that the city has not the proper authority by legislative enactment.

The Philadelphia Traction Company is going ahead with the work of changing over the Market street cable line to the trolley system. Poles are now being erected on Market street.

Telephone Service in Europe and America.

Gen. Benjamin F. Tracy, counsel for the Metropolitan Telephone and Telegraph Company, of New York, in his argument against the Gerst-Persons telephone bill at Albany on February 19, made these statements in the course of his remarks:

It is said by the gentlemen in their argument that the rate charged by the New York company is in excess of that charged in London and various other European cities. This is undoubtedly true, but there are good reasons for it. It has also been claimed before you that it is very easy to estimate the difference in conditions which might account for the difference in charges. We claim that the difference in conditions has not been properly taken into account by those who have appeared before you, and it is only by examining them in detail that the differences in charges for telephone service can be properly accounted for. To arrive at a fair comparison it is necessary to examine into all the conditions that govern the conduct of a telephone business. We can show that the telephone business in European cities is conducted under conditions differing from each other in each case and all differing from those that obtain in New York. In the first place, we have the fact that the average cost of living, the price of pretty nearly everything, is much less in Europe than it is in New York. When a man goes to London and finds that the legal cab fares are one-quarter what they are in New York, that clothes and many other things are less than one-half the price, that office and house rents are one-third the price, it ought not to cause a severe shock to his system or turn him against his own government if he finds that telephone service also costs less in London than in New York. But apart from the undeniable fact that the general lower cost of living in Europe tends to make the cost of any service or commodity cheaper in Europe than in America, a short examination into the methods of European telephone concerns will show that there is ample reason for their rates being lower than ours.

The points to investigate are these: Do they furnish the same quality of service as we do? Do they work under the same conditions that we do? Do they use the same improved and expensive apparatus and appliances and systems that we do? Do they have to bear the same expenses proportionally that we do? In answer to these questions, we say no to every one of them. We say that the European telephone companies and administrations do not furnish the same product that we do, because they do not offer the same facilities for general telephonic communication, nor anything approaching them. They do not supply the same quality of telephone service, either as regards the efficient transmission of speech or the rapidity of making connections between subscribers. They do not work under the same conditions because their systems generally are overhead and single wire, while ours is underground and double wire.

Further, the systems are in some cases owned and operated by the government, with all the advantages that a monarchical government enjoys of freedom from expenses that a corporation naturally has to meet, and of special rights and privileges that a corporation cannot possess. They do not use the same appliances and systems that we do. Very generally, they use the switchboards which we abandoned eight years ago, for more efficient and more expensive switchboards, which have, in some cases, been abandoned in their turn by us within the past two years for still newer and more expensive apparatus. They do not have to bear the same expenses, proportionally, as we do, because they pay lower prices for material by 30 or 40 per cent; they use less complicated and less expensive single-wire systems, and the single wire means not only the subscriber's line, but also the switching apparatus, and runs through the whole plant, affecting the cost of all parts of the system. They pay from one-third to one-half the rates for labor that we do, and by reason of their less complicated systems, containing a lesser amount of material per subscriber than ours, they use much less of this cheaper labor for a given number of subscribers than we use of our dearer labor. All this we can show you in detail by citing actual examples.

In the matter of labor, for instance, $1 in London goes as far as $4 to $4.50 in New York. Take rents. Space for a central office can be hired in London for less than one-fifth of the price paid for equivalent accommodation in New York.

While we admit that the rates for service in European cities are less than here, yet even those rates have been incorrectly stated by the gentlemen who have heretofore addressed you. For instance, you were told that the rate in London was £15. The rate is £20, and even this does not represent the amount which the subscribers may have to pay. For instance, the regular rate is limited to stations within one mile from the central office, and for every half mile, or fraction thereof beyond one mile, there is an additional charge of £3 10s. per annum, so that a man having occasion to use a telephone for a circuit of three miles would have to pay £30 or $150. In New York there is no limitation as to distance imposed upon the subscribers.

In London, the subscriber pays the entire annual rate in advance, which saves all risk to the company, besides giving it a year's interest on a large sum. In New York the rentals are collected monthly, after the service has been rendered.

Again, in New York every subscriber is furnished with a metallic circuit which enables him to communicate directly from his own station through the long-distance telephone to any station in the country this side of the Mississippi, and this side of Portland, Me., and as far south as Washington.

In point of fact, larger profits are made by the London system than by the New York system, owing to the ruling conditions of cheaper plant and labor in favor of the former. The last annual report of the London company shows the percentage of operating expenses to earning to be a trifle over 50 per cent. In New York it is over 80 per cent.

Mr. Sterne has in his house to-day a telephone from which he can talk to any person at any other telephone station between Portland, Me., and Chicago, Ill., or between Canada and Washington, and for his service he pays about $80 per year. But in London, where a man has a line which will enable him to talk between London and Paris, he has to pay an extra charge of $200 per year for such service in addition to the charge for local London service, and in addition to the toll charges for messages sent over such lines for connections between London and Paris. Therefore, if a man in London wants local telephone service and real long-distance service as well, he pays $300 a year or $60 more than the highest rate in New York.

But it is again said that the rates in New York are higher than they are in other American cities, and an attempt to prove this is made by comparing the lowest rates existing in other cities with the highest rates existing in New York. But this is not true, if you take into consideration the number of subscribers and the average cost to exchange subscribers in the different American cities. It ought to be obvious to anybody that it will cost more to furnish facilities for one man to communicate with 10,000 men than it will to furnish facilities to communicate with 3,000 men; hence it is universally true that the cost per subscriber depends upon the number of subscribers and increases rapidly as the number of subscribers increases; and this fact is acknowledged by this bill itself, because the highest rate fixed by the bill is applicable to New York city having the greatest number of subscribers, and the lowest rate fixed by the bill is applicable to those places having the smallest number of subscribers.

It follows, therefore, that in Boston, where they have only about one-half the number of subscribers we have in New York, and in Philadelphia, where they have only about one-third, and in Cincinnati less than one-third, they can afford to give service for a sum, per subscriber, less than can be furnished in New York.

In its telephone service New York stands without a peer. No city in the world furnishes anything like the quality of service that is furnished in New York; in no other city in the world has the equipment of the telephone system been brought to such a state of perfection as in New York; in no other city in the world has there been anything like the expenditure in plant, per subscriber; and in no other city are the subscribers furnished as much value in the way of service as in New York city.

It is the object of the managers in New York to place the entire system upon such a complete scale that any subscriber from his own station may communicate to any other subscriber east of the Mississippi River over the long-distance lines. Of the 10,600 telephone stations in New York, 10,000 have now been completed upon this improved plan, and it is expected that the balance will be changed during the next few months. In no other city in the United States has any such progress been made in the telephone system; and this service, unequaled in quality, is, as we have shown, furnished to our exchange subscribers at an average rate of $175 per year.

You will remember that Mr. Sterne told you that in no other city in America but New York and Brooklyn were the telephone rates over $100; whereas, the fact is that for the same class of service $180 is charged in Boston with 5,000 subscribers, $175 in Philadelphia with 3,500, and $150 in Cincinnati with 3,000 subscribers.

It has repeatedly been asserted before you that the average cost of furnishing telephone service to each subscriber does not increase with the increase in number of subscribers. Nevertheless this is an indisputable fact. Mr. Sterne has characterized this proposition as monstrous, but still he or his associates have recognized the theory in the preparation of this bill by apportioning the higher rates to the larger places and the lower rates to the smaller places. It is obvious then that the bill does not coincide with the arguments of its supporters, for if Mr. Sterne's contention that the average expense per subscriber decreases as the number of subscribers increases had been convincing, the rates for the larger places would be much lower than the rates for the smaller places. The sum of $27 then being considered by the drawers of the bill the proper rate for a small exchange, a large wholesale exchange would be able to do business, not at three times that rate, as in the bill, but at one-third of it, and about $9 would be the proper rate for New York. Theoretically, even this rate should decrease as the number of subscribers increased, and we should gradually arrive at a point where telephone service would cost nothing at all. The simple statement of the logical outcome of this proposition demonstrates its absurdity.

As a matter of fact, every practical man who has devoted thought to the telephone business has found what every intelligent man finds in any business—that the cost of any service increases with the improvement in quality and the increase in extent and amount. Let me quote you what Mr. Hospitalier, the well-known French electrician, says in a recent article in *La Nature*. He says that "all the expenses of furnishing telephone service sensibly increase as the square of the number of subscribers, while the receipts, based on a fixed tax, increase only proportionally."

Mr. R. B. Corey.

Mr. R. B. Corey, formerly general manager of the Electric Construction and Supply Company, has taken offices at Room 714, Havemeyer building, New York city, where his experience and a complete line of arc lamps will be placed at the disposal of his friends and customers. Mr. John C. Knight, under whose patents the Electric Construction and Supply Company manufactured arc lamps, will be connected with Mr. Corey, and the Wallace Electric Company, 307 Dearborn street, Chicago, will represent him in the West.

Mr. Corey has had many years of experience in this special line of business and has taken some of the largest arc lamp orders ever placed. He was the first man to make a commercial success of arc lamps for incandescent circuits, burning two in series. Mr. Corey will handle a complete line of arc lamps made in the simplest and most durable styles. The line will include plain and ornamental series, direct and alternating current lamps; twin lamps, focusing lamps of every type, photo-engraving lamps, searchlights, and complete theatrical outfits. Circulars, prices and all information can be had from Mr. Corey at the address given.

New York Electrical Society.

A meeting of the New York Electrical Society was held at Columbia College on Thursday, March 7. Mr. Charles S. Bradley delivered a lecture on "Alternating Currents in their Relation to Power Distribution." The evolution of the distribution of energy by electricity was traced, and the latest developments illustrated by means of a three-phase induction motor in operation.

EXPLOSIONS IN UNDERGROUND ELECTRIC MAINS AND SUGGESTIONS HOW TO PREVENT THEM.

BY ARTHUR SHIPPEY.

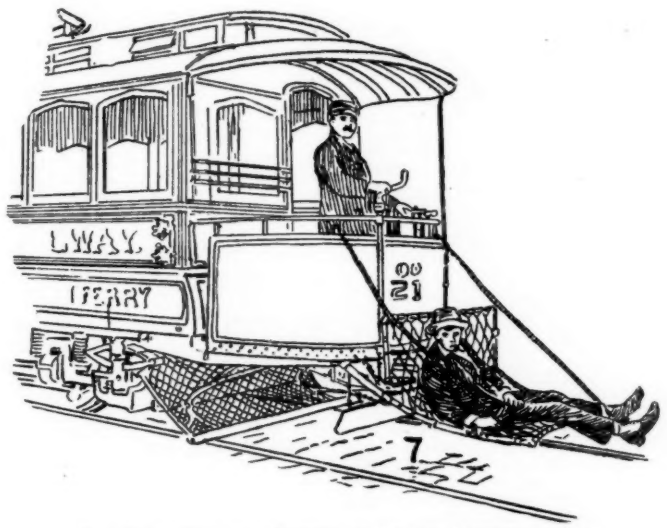
The many explosions which have recently taken place and are becoming more frequent in all parts of the world naturally set us all thinking as to what can be the actual cause of some of them. Therefore, in order to solve the problem, we must consider the subject matter upon all its bearings, and I think, to do this, that explosions in electric mains should be classed under three headings, viz.:

1. Those that are brought about by carelessness which of course, can be greatly reduced by more stringent rules being introduced and enforced to prevent them.
2. Those proved to be caused by short circuits, faulty fuses, corrosion, over-heating of the main cables, sparking, etc.
3. Those that frequently mysteriously occur, the cause of which as yet remains unsolved.

Many suggestions, from time to time, have been promulgated by several of our scientists both in England and abroad, but none, so far as I can learn, have ever suggested or even hinted at what I believe to be one of the real causes that has brought about several of these disasters, which have frequently occurred in various parts of the country in a most mysterious way; and would say my "theory" is that many of those explosions which have taken place both here and on the Continent during the past 10 years have been brought about under certain atmospheric conditions, and are caused by lightning flashes being conveyed to the earth through lightning conductors which need not, in order to cause an explosion, be fitted in the immediate vicinity where such explosions actually occur, for lightning waves are known to travel underground for many miles until they reach or are absorbed by water or damp earth, both of which have a great affinity for electricity. Then, again, it must not be forgotten that the principal thoroughfares of all large cities in which the electric mains are being laid are composed of a compound substance a semi-metallic nature consisting of earth and pulverized metals brought into existence by reason of the wear and tear of thousands upon thousands of tons of iron tires, carriage wheels, horse shoes and other pulverized metallic substances, into which compressed compound there is laid a net-work of gas, water and bare copper electric mains, a combination of which forms an absolute and complete passage for the conveyance of the flashing currents. Therefore, this is one of the problems to be solved amongst others and some method introduced by which explosions will be prevented from this cause in the future. I base my theory, which I claim to be fundamental, on the fact that many mysterious explosions have occurred in districts where thunder and lightning have been hovering about in the vicinity at the time. Hence, I am convinced that this is one of the real causes which has brought about the actual firing of explosive mixtures which naturally accumulate in the culverts and manholes of some systems. I may say that I think I have just hit upon a plan, provided my theory is proved correct, which will entirely overcome the whole difficulty, but I must refrain for the present from divulging the methods I intend to adopt until the system is protected in the States. I think Sir David Salamons' suggestion as to filling up the open spaces and manholes with small sand bags, in order to prevent excessive accumulation of explosive gas, a very good idea, and his plan should be thoroughly tried, as it will reduce the space and prevent undue accumulations. In England, Major Cardew has called special attention in his recent reports to the importance of using proper fuses, and it is to be hoped that the Board of Trade and also insurance offices will now insist upon contractors being more particular as to the type of main fuses, also fuse links, used by them, for, undoubtedly, to the slip-shod and make-shift manner this section of the industry is frequently scanted over in many instances, perhaps not wilfully, but from a want of better knowledge relating to the subject of fuse wires and their fusing points, which is often overlooked, could be traced not only several explosions which have occurred in the mains, but also many of the mysterious fires which have occurred in electric circuits by reason of these faults, which, if more carefully studied, would greatly tend to reduce the causes enumerated in category No. 2, as above described.

If you can spare space in your journal to record my views upon this subject please do so, as the theory and suggestions made may assist in solving the problem relative to the causes of several very mysterious explosions which have occurred both in American underground electric mains as well as those which are continually taking place on this side of the water. It would be interesting to obtain the views of American engineers versed on the subject, and whose ideas and experiences, if recorded, may throw more light on the subject and thus assist in preventing these sad disasters and loss of life in the future, unfortunately brought about by reason of the leakage of gas from old faulty gas mains known to exist in many districts where electric cables are continually being laid.

London, February 22, 1895.



THE BLAKISTONE CAR FENDER AS USED IN BALTIMORE, MD.

The Blakistone Car Fender.

Mayor Schieren, of Brooklyn, and Hon. William Berri, of the same city, spent a day in Baltimore, Md., investigating the merits of the fender adopted for the electric cars of that city. Mr. Mendes Cohen, civil engineer, and Mr. George Blakistone, president of the Central Railway of Baltimore, are responsible for the production of the fender adopted, which is described by Mr. Berri as follows:

The fender consists of a projecting device made with a light gas-pipe frame and a rope net. This catches a person knocked down and does not injure him. If an obstruction is passed over by the fender, that very act releases a spring which drops down a large scoop arrangement, just in front of the wheels of the car. There is also another appliance which works the scoop in case the raising of the fender fails to release it. The scoop is very strong and in pressing down hard upon the rail when in use acts also as an additional brake to the progress of the car. Apparently it is impossible for a person grown or a child to get under the car wheels with this device in use, and the Central Railway have had less than $1,000 to pay as damages since it has been in use during the past two years, while before that period they were injuring people all the time. The fender costs from $40 to $45 complete per car.

Central Union Telephone Company Pays the Income Tax.

The Central Union Telephone Company, in mailing checks for its last dividend, enclosed circulars notifying its stockholders that the company had paid the income tax on its earnings.

Mr. C. E. Trump, of the Novelty Electrical Works, Philadelphia, paid his New York friends a visit last week.

LITERARY.

The publication office of *Public Opinion* was removed on March 5, 1895, from Washington, D. C., to New York city (Clinton Hall, Astor Place).

Mrs. Humphrey Ward has written a three-part story for *Scribner's Magazine*, which will appear in early numbers. It is entitled "The Story of Bessie Costrell" and is the first fiction contributed to a magazine by the author of "Robert Elsmere."

"Standard Wiring for Electric Light and Power," by H. C. Cushing. Flexible morocco covers, 82 pages. Third edition, revised and enlarged. Price, $1. Sent, post free, on receipt of price by the ELECTRICAL REVIEW Publishing Company, 13 Park Row, New York.

The author seems to have struck a long-felt want, as the early preparation of a third edition of this book evidences. Former purchasers are duplicating their orders and the sale of the book has been widespread. For anyone interested in electric wiring no better guide book can be had.

The Atlanta Exposition.

For some days the management of the Cotton States and International Exposition, which is to be held from September 18 to December 31 at Atlanta, Ga., has been in consultation with the managers of the Southern Railway and the Consolidated Street Railway Company. The problem is how to handle the great crowds quickly and without friction. The model before them is the superb service of the Illinois Central, at Chicago. The Southern Railway bears a similar relation to the Exposition, and is putting in new tracks for the purpose of running trains on quick schedules. Mr. Joel Hurt, president of the Consolidated Street Railway Company, is figuring on a big business, and claims that he can handle more passengers than the Southern Railway. The Consolidated will have four lines to the park, and the Southern will have two tracks out and four tracks at the entrance, so that two trains can load and two can unload at the same instant.

"The Fourth Estate."

This interesting and ably-managed weekly publication, devoted to newspaper men, celebrated the opening of its new offices in the Postal building and the end of its first year of existence by a highly enjoyable reception the evening of February 21. There was in attendance the largest gathering of newspaper publishers ever seen together at one time, growing out of the presence in the city of the delegates to the convention of the American Publishers' Association. Messrs. Birmingham and Lancaster, the publishers of *The Fourth Estate*, are to be congratulated upon the success of their interesting publication, and upon the happy event that ushered in the beginning of their second year in their new and most commodious offices.

A NEW METHOD OF MEASURING ILLUMINATION.

(*Continued from page 133.*)

vide such lamps as will, at the spacing employed, give the illumination contracted for.

So far as we know, there is no actual apparatus in existence, other than that we are about to describe, that will directly measure the intensity of the illumination at a given point, except the portable photometer of Prof. Weber, described by Mr. Heinrich at p. 422, vol. xi, No. 7, July, 1894, of the proceedings of the American Institute of Electrical Engineers. In Weber's photometer the illumination received upon a screen from a small standard amyl-acetate or benzine lamp is compared with the illumination to be measured. The difficulty of obtaining a reliable portable standard lamp, the rather cumbersome size of the apparatus, and the fact that it does not obviate the difficulty of comparing illuminations of different colors, have led us to devise a new instrument based on entirely different principles. We call our instrument an illuminometer, and have filed applications for a patent on the same.

A certain intensity of illumination is required to render a definite object viewed at a definite distance clearly delineated to the eye. It is well known that the illumination received upon a printed page of a book or newspaper must have a definite value in order to render the printed characters legible, and that the intensi y of the illumination so required will, for a normal eye, depend upon the size and character of the print.

We employ this principle in the operation of our illuminometer as follows: A small test object of, say, printed characters is placed in a darkened box, sufficiently small to be readily carried in the pocket. The test object is exposed to illumination received from a translucent plate of porcelain or opal glass, which receives directly on its surface the illumination whose intensity is to be measured. Since the test object receives the light from this plate by transmission and subsequent diffusion, it is the area of the translucent plate exposed to the test object, in order to just render the latter legible to the eye, that determines the intensity of illumination upon the plate. A focusing eye-piece is placed opposite the test object for purposes of annulling the effect of any focal abnormalities of vision. A sliding shutter movable by a milled headed screw permits the effective area of the opal glass plate to be reduced until the amount of light received by the test object just permits of its legibility.

The detailed construction of our apparatus will be understood from an examination of Figs. 1, 2 and 3, which represent, respectively, a longitudinal cross-section, a transverse cross-section and a plan view. A box XX, blackened inside to prevent the reflection of light, is provided with a tube TT, as shown. The test object is placed on a block at B, opposite the focusing eye-piece E At the top of the box is a window WW, closed by a translucent diaphragm of porcelain, opal glass, or similar material. This diaphragm is placed so as to act as a secondary illuminator of the test object at B.

In order to regulate the amount of light which passes from the window WW, to the test object, a sliding shutter SS, operated from beneath by a milled headed screw C, is placed in guides beneath the window, so as to cover any desired fraction of its surface. In order to determine the effective area of the window, *i. e.*, the uncovered portion which admits light to the test object B, the index I, attached to the shutter, moves over a calibrated scale S, from which the amount of illumination on the window WW, may be immediately read off in suitable units.

Calibration of the instrument is effected by exposing the window WW, to known intensities of illumination in a photometer, or darkened room, and marking off upon the scale S, the points at which the indications of the instrument are obtained.

By the illumination on a surface is meant the quantity of light it receives per unit of area. Illumination may be expressed in terms of some unit illumination obtained from a definite source at a definite distance. Thus, a standard candle produces a definite illumination at a distance of a foot, and this illumination is sometimes called a candle foot. A less objectional and more generally recognized unit is the illumination produced by an international standard candle at a distance of one metre, and this unit is called the bougie-metre or the lux.

The international standard candle above referred to is the *bougie decimal*, or the one-twentieth of the Violle, or molten platinum standard of light, adopted by the Paris International Electrical Congress of 1889. Authorities, unfortunately, differ as to the relative value of this decimal standard candle in terms of the British candle or Sugg, which burns 0.1296 gramme per minute; but Everett in his C. G. S. system of units, 1891, gives data which make the international candle 0.988, or about 1.2% less than the standard British candle. Approximately, therefore, one lux is the illumination produced by a standard British candle at a distance of a metre.

In employing our instrument for such a purpose, for example, as measuring the illumination upon the surface of a table illuminated by daylight, candle-light, or incandescent light, we place the illuminometer upon the table with its window up, so that its window being only two inches above the table practically coincides with the surface whose illumination is to be measured. The eye is then applied to the eye-piece and the test object focused under the full illumination. The shutter is then gradually moved over the window until the test object just remains legible, when the number of luxes in the illumination of the table are shown by the index on the scale.

The degree of accuracy with which these measurements can be made, though small as compared with such determinations as length, mass and time, nevertheless does not compare unfavorably with photometric measurements in general. It is well known that two observers may vary in their determinations of the candle-power of an incandescent lamp by five per cent, and, when the lights to be compared have different colors, the variation is often much greater.

The mean error of a single observation with our instrument is 10 per cent; that is to say, if a number of measurements be successively made of an illumination within the range of the instrument, the average deviation of any single measurement from the mean of all the measurements is, with the instrument here exhibited, about 10 per cent, although we believe certain changes we have in view will notably reduce this percentage. Such tabulated observations are appended. In the instrument exhibited, the graduation of the scale extends from four luxes, by single luxes to 15, then to 35 in divisions of five luxes, then to 70 in divisions of 10 luxes, while the highest reading is 400. The total length of the scale is 1.5 inches. The total length of the instrument is 5½ inches, its breadth is 1.5 and its height, excluding the milled headed screw, is 2¼ inches so that the apparatus can readily be carried in the pocket. Its weight is 10 ounces.

It might be supposed that two different observers, having different limits of distinct vision, would obtain different results in determining a given illumination by the use of our instrument. In point of fact, however, we find that by the use of the focusing eye-piece, distinct vision of the test object being readily secured for each observer, the results of different observers do not appear to differ by more than the limits of probable error for the apparatus.

It is known that an illumination of five luxes is sufficient to permit the reading of ordinary print, although, on physiological grounds, the eyes should not be used for continuous reading at illumination less than 10 luxes. Fifteen to 25 luxes may be regarded as proper artificial illumination for reading. In the same way, the amount of light required to permit the performance of other kinds of work is readily determinable. It is evident, therefore, that our illuminometer is applicable to the determination of the question as to whether the illumination of a given area is, or is not, sufficient for the character of work to be done, and that the measurement of illuminations can be made with a reasonable percentage error for all intensities within the range of the apparatus. This range can be varied by altering the character and dimensions of the window, as well as the character and dimensions of the test object.

It will be evident that the advantage of such an instrument consists in the fact that it entirely dispenses with the necessity for the use of a portable standard of light, thus removing a constant source of unknown error in apparatus previously employed for this purpose. Moreover, the instrument does not require any great skill in its use, and with simple directions for use can readily be employed by an inexperienced observer.

It is evident that our illuminometer will permit a direct determination of the candle-power of a source of light by measuring the illumination produced at a fixed distance by that source of light alone. Thus, for example, if an incandescent lamp has its illumination measured at a distance of one metre from the center of the filament, the number of luxes indicated by the instrument, when its window is perpendicular to the rays from the lamp, and all other sources of light are cut off, will give directly the number of international or decimal candles in the lamp. It is, therefore, possible to measure the candle-power of a lamp in its socket, provided all other lamps in the neighborhood be extinguished, and that a black non-reflecting cloth be placed so as to prevent any appreciable amount of light from entering the windows, except that radiated directly from the lamp.

Our illuminometer, therefore, becomes indirectly a portable photometer.

In the use of the instrument, care must be taken to keep the glass of the eye-piece and of the window clean, as otherwise the observations may be vitiated. The use of the focusing eye-piece is intended to avoid the necessity that might arise for wearing glasses, by which the quantity of light entering the pupil of the eye from the test object would be necessarily reduced.

Since the indications of our instrument depend upon the physiological effect alone, and not on the contrast of an unknown with a known illumination, all questions as to difference of color in the illumination to be measured are avoided, so that a measurement of the intensity, *i. e.*, the candle-power of an arc lamp, can be made without employing a special arc standard.

Apart altogether from the use of our apparatus, the National Electric Light Association doubtless recognizes the fact that there exists to-day no generally accepted standard of illumination. We would respectfully recommend that the association consider the advisability of adopting as the unit of illumination the lux or bougie-metre, *i. e.*, the illumination produced by a decimal candle at a distance of a metre. This unit has been under consideration for some years, and has been provisionally adopted by several writers in this country and Europe.

OBSERVER X.—INCANDESCENT LIGHT.

Observations.	No.	Sum.	Mean.	Residuals.	Sum of Residuals.	Mean Residual.
8.5	18	132.4	10.184	1.584	10.0.16	0.77
9.6				0.584		
9.4				0.784		
11.4			1.216			
12.2			2.016			
9 6				0.384		
9.2				0.984		
10.2			0.016			
10 3			0.316			
9.8				0.384		
10.2			0 013			
11.2			1.016			
10 6			0.416			

Result, 10.184 mean error 0.77 (7.56%).

OBSERVER W. A.—DAYLIGHT.

Observations.	No.	Sum.	Mean.	Residuals.		Sum of Residuals.	Mean Residual.
47.	13	504.5	46.5	0.5		55	5
37					9.5		
50.5				4.0			
57				10.5			
43					3.5		
45					1.5		
38.5					8.		
40.3					6.		
46.					0.5		
55				8 5			
55				8.5			
48					3.5		
47				0.5			
				32.5	32.5		

Result, 46.5, Mean error 5 (10.75%).

DISCUSSION.

Mr. Haskins: When I arrived in Cleveland, it was a matter of regret that I was unable to procure a copy of the interesting paper read, because I felt if I did not procure a copy I should not be able intelligently to discuss it. Now that I have heard the paper, I think I can discuss it perhaps as intelligently as if I had seen a copy. There seems to be one question which it is difficult for me to appreciate, and that is that the permeability of the translucent screen should be the same with different colored rays of light. It seems to me the permeability of the screen must be greater or less as the rays are more or less white or red. I know that the human eye certainly appreciates one more than the other in different individuals. Some individuals appreciate the lower rays of the spectrum more quickly than others. Some people see better in the dark than others. The cat sees better in the dark than we do. That seems to me to be the question which it is difficult for me to reconcile with the instrument described. I recollect having an instrument in my possession which did not accomplish just this thing, but which is somewhat analogous to it, which is, I believe, used in Europe to some extent by scientific photographers. It was used for measuring the photographic value of light, and it consisted merely of a number of squares of glass, each square of glass numbered serially, and these squares arranged as one table under which should be placed, as in a printing frame, a sensitive paper, silver paper of known sensitiveness. All that was then done was to expose this square to a given light for a given time, and on removing the sensitive paper, the last square, or darkest square which ceased to give an impression on the sensitive paper, told the photographic value of the light, and how long an exposure was needed for a given result. I appreciate that does not accomplish at all the same thing as the instrument just described. It measures the photographic value of light; it measures the white rays; but this suggested to my mind that other question I have just mentioned, the permeability of the translucent screen to the various rays as they run from the white to the red lines in the spectrum.

Professor Thomson: The question of the measurement of illumination seems to me to be analogous to the measurement of temperature, largely by feeling, though, perhaps, not liable to such great errors as might exist in that case. The object of the instrument is undoubtedly a good one, and it is undoubtedly meant to meet that condition which we as members of the National Electric Light Association often have to meet—a dispute as to whether a certain light is doing its duty, not whether the light up there or somewhere else was producing a certain illuminating effect, but whether it is actually delivering at the useful point on some surface, and of a quality which would enable us to read by it. Undoubtedly that is what we are driving at when we hang up a lamp. We do not care anything about the light up there; we want to have it here; and if we can arrange some means whereby, by placing an instrument here, we can get an exact idea of the illumination, measured by the degree of visibility perhaps, then we have certainly accomplished a good object and a valuable one. It occurs to me, however, that the question resolves itself into a physiological question. We know perfectly well that visibility depends on contrasts. If we turn rapidly from a highly illuminated surface and then down at some other object, we find that we have to wait a little while before the eyes will respond, and it depends altogether on the degree of brightness of the object towards which we looked how long we will have to wait. It is difficult to say how long we shall have to wait before the effect of that light in our eyes is removed absolutely. That is an uncertain question. I simply state this as bringing out one of the points in my mind. The object of our coming here is to get at the truth and know where we are on these questions; it is not to make captious criticisms, but to know where we are. There is a difference between vision—I think the rate at which an impression is made and the legibility of an impression are two different things. Sometimes we get an impression quickly, and at other times we get an impression slowly. It would hardly be proper to measure everything by legibility, depending on time of impression, because the illumination as to rate may come in there. I think the eyes are different. I think it has been recognized that there is a different rate of impression; what we may call continuity of impression.

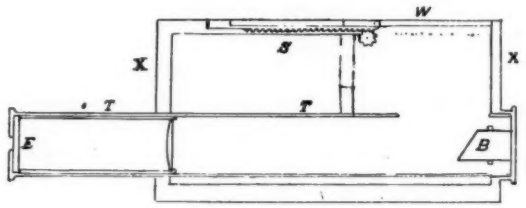
Another criticism I would make is that the printed slip that you would use in this instrument, after you have used it for a while you get to read it more easily than at first. If you are going to change that printed slip every time, you may change the character of the surface, you may have surface not so white or a little different, and you cannot be sure you are getting the standard surface. Every one knows if he has read a thing he can read it much more

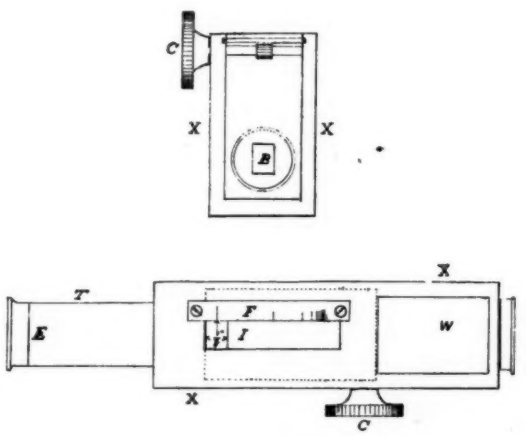
easily if he has to read it again and knows what is there. The effect of imagination comes in—that is another physiological action which has to be counted on. It is a question to my mind, in an instrument of this kind laid aside and not used for a time, whether the paper will maintain its integrity as a surface for receiving and diffusing light. We know that it is darkened by age. I think it would certainly be required that we should use some material like porcelain, like a watch face, absolutely permanent, if we employed the method at all.

There is another question. Is it true that with different individuals the iris opens or responds equally; do the eyes have the same aperture to receive light? I have my doubts so far as my observation goes. In the eye of a child the iris opens wide; but with an older person the eye is not so flexible; in fact it may finally become partially fixed. It will not give the same aperture of illumination; the diaphragm is smaller and does not respond so easily. In certain forms of incipient disease the first indication is that the iris does not respond easily. What percentage of difference that would make in reading anything or seeing anything with the eye, that was at all illuminated, I do not know; that is simply something which I put out as a suggestion. But it is a matter of my personal observation that if I am looking in a darkened room I see all the objects for a little while, they disappear, and then I see them again, as if the sensitive material of the eye was renewed in gushes. There is some peculiar connection of the sensoria which, as it were, brings on a wave of sensibility, then wipes it out, and then brings on another wave.

Then comes the question of color-blindness in people. I have met a number of people subject to color-blindness—not sensitive to the red rays—some more than others. It is well known that the power of vision to the higher rays is very different to that of the ultra-violet rays; some can see the lavender in the spectrum, others scarcely at all. It happens that at the extreme violet part of the spectrum there is not a great amount of useful illumination, but still there is some, and it might make a difference in some cases. I simply bring these points forward as indicating that we find it necessary, before adopting a method of this kind, to compare the results of a large number of observations to find out whether there was a difference to be noted, or whether we could rely upon a fair average result. Ten per cent out would not bother us very much, and perhaps all these errors combined might, if we used due precautions, be included within the ten per cent. Then the instrument undoubtedly would have my unqualified endorsement.

Mr. Ayer: The adoption of an instrument of this character would seem to me, as expressed by the other speakers, to be a thing which should receive a great deal of consideration. Aside from the different physiological results which might accrue from the difference in the eyes of different people, a standard instrument that was brought into use and put into the hands of people who are often endowed with power to determine matters in dispute, but frequently work very serious hardships, not the least of the points involved in a thing of that kind is the integrity of the persons using it. The point made by Professor Thomson about the familiarity with the letters, where imagination comes into play, is a very important one. We had a case of this kind where there were produced a number of sheets of paper with varying sizes of letters printed on the sheet. A committee was selected who remained with their backs toward the light so as to avoid affecting the vision by looking at the lamps, and each one would walk a definite distance away and then endeavor to read a certain number of lines aloud. We found variable results. One man would read line number two at 200 feet, and another, line number three the same distance and so forth; but as we proceeded, we found a change. We found that the man who first could only read line number two 200 feet away, could read line number three, the latter being a finer print. The men I think were naturally unbiased in the matter, but they gradually became familiar with the printing. To overcome this familiarity, at the suggestion of the chairman of the committee, we had printed a series of slips with a line of Volapuk, a half-dozen words on each line, and it was practically impossible to memorize it, and after an evening's work of several hours we found this relation continued to exist throughout the whole evening. The conditions did not change, the characters could not be so easily memorized; giving abundant evidence to my mind that it is very easy to have the imagination come in as an element to determine anything you have as a fixed standard to judge by.





FIGS. 1, 2 AND 3.—HOUSTON AND KENNELLY'S ILLUMINOMETER.

Mr. Kennelly: The first point raised by Mr. Haskins is a question as to the relative sifting power of the translucent screen for various colors of light, but it seems to me—and I think it will seem to you on reflection—that that difficulty is entirely eliminated by the very method employed in calibration. If we have anything in light, if we have any basis in applying any value to it, it is a standard of intensity; that basis may be a standard candle, that basis may be a Hefner-Alteneck lamp. Whatever these values may be, they are standard and recognized as such. If, with a definite standard to take the instrument at measuring distances from that standard, you have a definite known illumination, and if you calibrate and mark off the scale of the instrument to what that illumination must be, you have eliminated for that character of light all possible questions as to the degree of sifting of the translucent material. It is true that the argument does not hold so soon as you change the character of the light. The illumination measured on this table by incandescent light, if an incandescent lamp had served you as the standard, and a calibration was made by an incandescent lamp, might cease to be the true illumination measured by oil or arc light; but by actual trial we have found that the errors which may be induced by the variation which must exist, by the absorption of material for different colors, is too small to be noticed. A 16 candle-power lamp measured for its intensity of candle-power by the instrument in its use as an indirect photometer agrees with the measurement obtained by reckoning it from calibration obtained by a standard candle, within the limits of probability of the instrument.

In regard to what Professor Thomson has so eloquently explained with reference to the unfortunate power of our eyes, I grieve that our eyes should be open to such grave impeachment, and in fact I am only glad, after reading of the troubles to which we may be liable, that we have anything which we may call eyes at all. No two eyes see alike, and it is not possible to get an instrument, based on the agency of the eye, to be absolutely correct; but on the other hand I am pleased to remember that our eyes have some definite value, and just in so far as our eyes are perfect and normal, just in so far can we conduct the measurements relied upon.

In regard to the figure in the illuminometer, there is no doubt as to whether you know it or not. They are simple figures consisting of five characters, and after you once read it you can scarcely fail to recollect what you read. You know very well what the characters are. You simply endeavor to bring them down until you cannot read them. All these errors, which are inherent in any apparatus involving the eye, have, after all, a certain limit. I will ask any gentleman present if he can tell me what the illumination upon the surface of that table is, within 50 per cent. I will feel quite pleased if any gentleman can tell me within 50 per cent what it is. We can measure it within 10 per cent. Surely you are glad to have something to tell you within 10 per cent, if you cannot estimate it within 50.

Professor Houston: I do not think it necessary to carry out this discussion very much longer, though there are one or two points I would like to discuss in answer to the objections that have been raised—happily by gentlemen who have preceded me. As to the permeability of the secondary illuminator, as questioned by Mr. Haskins: Yes, there may be some question as to its being more permeable to a light of certain frequency than another. I think the explanation by Mr. Kennelly of the methods we adopt in calibrating the instrument obviate any objection that may have existed in that direction. As to the question ably raised by Professor Thomson, it is unfortunately true that there are limitations to all our senses. These limitations are by no means restricted to the eye; they apply to all our senses; and to a certain extent the objections which the Professor has so pertinently brought, as limiting the use and applicability of our instrument, must necessarily apply to any instrument of physical research that can be employed. As to how long one should wait until the eye gets rested after reading the instrument, I think the answer is, fairly, he should wait until he can read the test object inside the instrument. He cannot get that in a moment. It may require a motion of the slide shutter, so that his eye will be exposed once or twice to an increasing and a decreasing illumination, and by the time that he can read it I think his eye would be a fairly normal eye, and in the same way that would answer, I think, the objections as to the time legibility—as to whether we can see a thing rapidly or not. After all, the use of this instrument only requires that a person shall be able to do what his training has taught him to do since he first opened his eyes in this world—to be able to see an object with fair distinctness—that is all. There is very little judgment required, except that he must determine whether or not he can see well enough to do a certain thing, that is, to read. As to color-blindness, that does exist; but I question very greatly whether the doctors, in their interest in physiological research or their willingness to say that certain people on the railroads should not be in charge of locomotives, may have permitted their judgments to be warped. I do not believe that color-blindness exists in anything like the extent it is stated to. If it does, this instrument is not limited to be used by five or six people, but it may be used by anybody, and in this way the actual facts can be known.

That "Lack-of-Interest" Brooklyn Strike—British Journalistic Enterprise Again.

No, no, dear ELECTRICAL REVIEW, you have been wool-gathering, and no wonder can therefore be expressed at your missing the point. We always leave to our contemporaries the pleasant duty of padding out their columns with what is of no earthly interest, confining our remarks to briefly stating the facts of any particular case. So, of course, we left the lack-of-interest Brooklyn strike to them—and to you. Do you feel better now?—*London Electrical Engineer.*

[Don't you "dear" us! We don't like it. How can we miss the point when there isn't any? We feel all right, but are sorry for you.]

NEW YORK TROLLEY RULES.

RECOMMENDATIONS OF THE STATE BOARD OF RAILROAD COMMISSIONERS—BROOKLYN'S TROLLEY TROUBLE.

The New York State Board of Railroad Commissioners, last week, sent out from Albany the following recommendations as to operation of electric and cable cars on street surface railroads :

First—Every car shall be equipped with gates on both sides, which shall be closed on the side next to the adjoining track. No person (except an instructor, when necessary) shall be allowed to ride on the platform with the motorman on any electric or cable car.

Second—On all open cars there shall be attached a guard on the side of the car next to the adjoining track, running the entire length of the car, to prevent passengers entering or leaving the car on that side ; this guard to be of such a nature that it may be transferred from one side to the other.

Third—An efficient guard or safety fender shall be attached to the trucks of all electric and cable cars. This to be done as quickly as possible. The question of fenders on electric and cable cars is one to which this board, for the past year, has given its careful consideration by personal examination as to the practical working of the several forms in use in different cities in the State, and also by examination of types used in other States. The time has arrived, owing to the rapid increase in the number of electric and cable cars, when the adoption of the best obtainable form of fender is urgent. The companies should not wait until a perfect fender is obtained, but they should get the best forms at present in use and improve upon them until the above conditions as near as may be are realized. The final aim of railway officials and employés should be that, while the car may be equipped with the most improved form of fender, its operation should be such that there will be no occasion for its use. The cars should be operated so carefully that accidents will rarely occur. If the suggestions made by the board as to regulations and care should be carried out, with due co-operation by the companies and by the public, electrical propulsion would be as safe as the use of horses has ever been.

Fourth—The speed of cars shall not exceed four miles an hour crossing streets.

Fifth—Where two or more street car lines cross, or where they merge, an agreement shall be made as to which line shall have the right of way; the car that has not the right of way shall come to a full stop before entering on or crossing over the tracks of the other line on the joint track.

Sixth—Inspectors sufficient in number to attain and preserve the best discipline shall be employed by all electric and cable railroad companies. Employés on cars shall wear a uniform cap, at least.

Seventh—Cars passing in opposite directions shall not meet on street crossings.

Eighth—At congested points on the lines of such roads a sufficient number of employés shall be placed to protect the public and insure all possible safety.

Ninth—That the speed of such cars be reduced to the minimum on all curves where the view is obstructed.

Tenth—That the use of some improved form of air brake, similar to that used now on some of the cars of the Broadway and Seventh avenue and 125th street cable railroads in New York city, be considered by the managers of all electric and cable railroads. During the past year the board has made examinations as to the movements of street cars in the cities of the State and is impressed with the benefits which might be derived from the use of some form of power brake by street railroad companies. The necessity of quick stops on steam railroads, which led to the adoption of the straight air brake and afterward to the automatic brake, is now being experienced on street railroads operated by cable and electric power. Instances are frequent where the reduction of speed in a second of time is necessary to prevent accidents, and this can only be secured by the adoption of some form of air brake.

Eleventh—That all applicants for positions as motormen shall be subjected to a thorough examination as to their habits, physical ability and intelligence. If this examination is satisfactory the applicant shall be placed in a shop or power house, where he can be taught and made familiar with the power and machinery he is about to control. When this is done he should be placed on a car with an instructor, and when the latter is satisfied as to the applicant's capability for the position of motorman he shall so certify to the manager, and, if appointed, the applicant should first serve on the lines of least travel. These requirements will necessitate the employment of first-class men, and they should be strictly held to the observance of all ordinances, rules and regulations.

Twelfth—All cars on electric railroads where there is a grade of over three per cent shall be equipped with sand boxes and sand.

Thirteenth—Stops should be made only on crossings. Where blocks are long, stations or stopping places should be designated.

The commissioners also present a number of suggestions relating to the operation of the trolley lines in Brooklyn, regulation of speed, etc., saying :

The speed of such cars in suburban districts should not exceed 12 miles an hour. Regulations as to the rate of speed in the more populous localities of large cities must, necessarily, be left to the local authorities. Where it becomes necessary for the board to interfere as to this question, special recommendations applying to the particular localities will be made. It is undoubtedly customary in many instances for motormen on trolley cars to run at an excessive rate of speed. The attention of local authorities is called to this subject, and it is earnestly recommended that they take action in the matter.

The board's attention has quite recently been called to the statement of Professor Plympton in the annual report of the Brooklyn Subway Commission, wherein he says, in speaking of the trolley system :

"Regulation of the speed can probably be accomplished only by a mechanical governor which will limit the rate of the motor to that required to propel the car to the maximum legal velocity."

If such a device is practicable, it will be a very satisfactory solution of the question. If it is not, the board would suggest to the consideration of the officials of these roads the use of some form of indicator on each car whereby the motorman, as well as the passengers, can tell at a glance the rate of speed maintained by the car.

Mayor Schieren, upon receiving a report last week from the Brooklyn Subway Commission setting forth that the speed of the trolley cars had ranged from 12½ to 15 miles an hour in some parts of the city, at once sent for Presidents Lewis, Norton, Partridge and Wicker. In the presence of Police Commissioner Welles the Mayor called the trolley presidents to account for allowing such a high rate of speed. At the close of the conference he made this statement :

I shall arrest the presidents of the roads if necessary to bring this thing to an end. I am determined that this thing shall cease at once. I shall probably ask the aldermen to appoint an inspector to watch the cars and report violations of the ordinances. It is impossible to arrest motormen and conductors on cars which are going at the rate of 15 miles an hour, but they can be arrested on the strength of the inspector's test.

Paying and Non-Paying Advertisers.

[*From The Western Electrician.*]

As we expected, our more or less respected contemporary, the *Electrical World*, carried last week each and every advertisement declined by the *Western Electrician*. These will, no doubt, with many more like them, go to swell the *World's* next "comparative statement" of amount of advertising carried. Oh, well, we can stand the "comparative statements" if the *World* can stand the dead advertising.

But how about the *World's* paying advertisers? How long will they continue to put up with such unjust discrimination against themselves?

Advantages of the Vacuum System of Exhaust Steam Heating.

John A. Serrell, 30 Cortlandt street, New York city, representing Warren Webster & Company, of Camden, N. J., has recently completed installation of a vacuum system in the Third Avenue Railroad Company's repair shops, at Third avenue and Sixty-fifth street, New York city, which emphasizes to a marked degree the advantages of the vacuum system where exhaust steam is available.

The repair shops are all on one floor, covering an area of about 200 by 450, with high ceilings filled with skylights, and the main room exposed to north and west, is about 200 feet wide by 300 feet long, without partitions.

This was piped in the usual manner for live steam heating, with supply mains of ordinary size for this class of work; special connections were then made from these mains to the 20-inch exhaust pipe from the engines of the cable plant, and the returns run to a sealed overflow in the boiler room. A vapor pipe was taken from this seal above the water line and connected with a small condenser, by means of which a partial vacuum is maintained in and the steam sucked through the heating mains from the special connections in the main exhaust.

As the exhaust is absolutely unobstructed by the special connections, there is less back pressure on the engines when the heating system is in operation than at other times. The water used for condensation is the boiler feed, which in passing from the pumps absorbs the heat in condenser and is forced on to the feed water heaters.

The exhaust is passed through efficient oil separators before entering the steam heating mains, and is thereby relieved of the cylinder oil, and when the heating coils have been thoroughly cleaned of all dirt consequent on erection of the pipe work, they intend to utilize the hot water of condensation from the coils for boiler feed.

When this is complete the plant will be in the anomalous position of costing less to operate while heating this large area than it does to operate the power plant alone while developing the same amount of power and not heating.

Were the plant so situated that the cable company could make contracts to furnish steam heat to surrounding buildings, a very profitable arrangement might be established, as there is sufficient exhaust steam available to heat several plants as large as the present one, and in each case the value of the hot return water would more than offset the cost of operating the system.

The Kings County, N. Y., Grand Jury has been investigating the peculiar circumstances under which the contract was made for furnishing the little town of Flatlands with electric light for a period of 40 years at $49,000 a year, and it is said that some indictments may be submitted when the inquiry has been closed.

A Defense of the "Deadly Trolley."

Mr. D. J. Tapley, of Brooklyn, N. Y., recently sent the following communication to the New York *Sun* :

For some reason the newspapers have had a good deal to say in condemnation of the trolley car and its record of "100 fatal accidents" in Brooklyn. It seems to me that the case is not sized up judicially, and that most of the blame is misplaced. Nearly every fatality of this class has resulted from contributory negligence or gross carelessness, or even from suicidal purpose. The trolley has no monopoly as a source of danger. Children who are allowed to run the streets without being properly cautioned, and grown people who, from intoxication or any other cause, tempt fate recklessly, are always liable to disaster, fatal or otherwise. A larger number of people have been drowned by falling into the water from the piers, since the advent of the electric motor, than the trolley has to its credit, yet the papers have failed to harp on the deadly dock.

The trolley, by lessening the defilement of the streets, has so ameliorated the sanitary condition of the city atmosphere that it has saved many times the number of lives it has destroyed. It has furnished a quick and comfortable transit to the outlying wards, which has reduced the prevalence of grip and pneumonia among suburban passengers more than one-half. Many of your readers can recall the Winter cars, with their slush-soaked straw and foul odors, and the tiresome and dangerous delays in the snow, when the passengers were forced to walk in the storm, or even to assist the wretched horses by pushing. Many a man has gone down to his grave from a cold contracted on such a trip. The trolley has saved thousands of lives by enabling the mechanic and clerk to move their little ones from the unwholesome tenements of the city to the pure air and sunshine of the country. It has added in dozens of ways to the sum of human welfare.

Why, then, does the press persistently attack a system which accomplishes so much good that it has become a great public necessity?

As a matter of fact, the number of accidents was decreasing regularly as people became accustomed to the danger, until the strike substituted a set of comparatively inexperienced motormen for the old hands, and placed them under the necessity of protecting their own lives as well as those of foot passengers. The workmen who were responsible for these dangerous conditions, who left their posts on the plea that the wages were so low, and the labor so onerous that they could do better in other lines of employment, are now proving their insincerity by fighting for their old places at the old price.

For a practical suggestion I propose that the foot passenger shall have the right of way on the sidewalks and the crossings; which are the continuation of the sidewalks. If the trolley injures any one at the crossings, hold the company rigidly responsible. Let the trolley and other vehicles have the right of way at other points of the street, and if any one chooses to cross, let him do it on his own risk and responsibility. Let parents teach this rule to their children and warn them of the danger of crossing in front of vehicles, and let boys stop the reckless bravado which dares such danger in wanton fun.

Argon: The Supposed New Element in the Atmosphere.

The large, distinguished and unprecedented meeting of the Royal Society, on January 31, received the paper on "Argon: A New Constituent of the Atmosphere" with enthusiasm, and, although so many eminent personages were there, the absolute failure of the faculty of criticism on that occasion forms one of the most curious episodes in the history of the Royal Society of London.

The facts as, up to the present time, disclosed by Lord Rayleigh and Professor Ramsay are as follows: The weight of a litre of atmospheric nitrogen at 0 degrees centigrade and 760 millimeter barometric pressure is 1.2572 grammes. The weight of a litre of nitrogen derived from nitre or ammonia is 1.2505 grammes. The theory by which Rayleigh and Ramsay seek to explain this difference of 6.7 milligrammes between the weights of atmospheric nitrogen and of the nitrogen derived from nitre, is that the presence of argon in the atmosphere is the cause.

Let us now see how far the experimental evidence bears out this theory. Argon, say its discoverers, is heavier than the nitrogen of nitre, the relative weights of equal volumes of argon and nitrogen being 20 and 14. That is to say, one volume of argon weighs very nearly as much as one and a half volumes of nitrogen. Now, in order that the excess of density of atmospheric nitrogen over nitre-nitrogen may be accounted for, the amount of argon in atmospheric nitrogen must reach one per cent by volume. Indeed, in strictness, a little more than one per cent is demanded. According to Rayleigh and Ramsay, metallic magnesium possesses the property of combining with nitrogen at a bright red heat, and of refusing to combine with argon; and by taking advantage of this property, Rayleigh and Ramsay have brought out a method for the preparation of argon from air. In their paper they give instructions how to prepare argon by that method, and, what is more to the point, an example indicating the yield. They seem to have operated upon 100 or 150 litres of air, or, rather, of air from which the oxygen had been removed by red-hot copper in the well-known manner. In the actual experiment, the details of which they publish, the yield of argoniferous nitrogen was about 1,500 cubic centimeters, which, of course, would be about one per cent of the original atmospheric nitrogen. But now comes the remarkable fact: On further investigation, this one and one-half litre did not turn out to be, approximately, pure argon. It was not even strongly argoniferous; it dwindled down to 200 cubic centimeters on further treatment with metallic magnesium, and the 200 cubic centimeters had a specific gravity of 16.1 instead of 20, showing that only 70 cubic centimeters was real argon. Thus actual experiment indicates that the real proportion of argon in the air is only about 0.05 per cent by volume, and we are driven to the conclusion that the difference of density between the nitrogen of the air and the nitrogen derived from nitre cannot be explained by the existence of argon in the air in the small proportion indicated by the actual extraction of the argon.

Chemists, with much practical experience in original research, always attach importance to the yield of the new substance, and in cases where, as in the present instance, the yield of the new substance is only about one-twentieth of that which the theory requires are inclined to regard the whole investigation with suspicion. The very existence of argon is at present in doubt, and will remain in doubt until the extraordinary failure of yield has received satisfactory explanation. — *London Electrical Review.*

The Pony National Telephone.

It was evidently only a question of a few weeks when an inexpensive telephone would be produced. The Pony National, with its excellent compound receiver and powerful granular carbon transmitter, will soon reach every nook and corner of the country, as it will do the work of an instrument now barred from many a plant, corporation and home, on account of excessive cost.

The uses of this important instrument can be better explained by the following cut showing the National (metallic circuit) exchange system. This system may not attract attention at first, but, like the National telephone, it represents a modern system of the day, claimed by its manufacturers to be superior to all others and by far the least expensive.

Using the Pony National set in connection with the metallic circuit call system as above, the magneto bell can be dispensed with altogether. Party or "club" lines can be constructed to accommodate from two to a dozen or more subscribers; each subscriber can call central without disturbing others on the same club line. Among the best exchange systems of the Bell company to-day are those of Philadelphia, Atlanta, Ga., and other places where three wires are used, the third wire being a calling wire. In the National system the third wire is dispensed with, the calling circuit being completed through (one side of the subscriber's loop), secondary of operators by induction coil K and the "head" receiver L to ground post. (See illustration.)

The Pony National set is particularly valuable for private lines, factory use, etc., or what is termed an intercommunicating service, as the transmitter battery is also used for calling, or one central battery can control a number of instruments for talking and ringing.

To illustrate: No. 50 desires to talk with No. 75. He places the receiver to his ear, at the same time pressing button at bottom of bell box, and then calls into the transmitter 75 on 50. The operator at exchange, who is always supposed to have the head receiver at her ear, makes the connection by means of a magneto generator ringing up No. 50. When through talking, pressing the button and calling into the transmitter "to disconnect," is all that is necessary.

The owners state that it is an undoubted fact that the small National compound receiver is the most powerful of its kind to-day in the country. This instrument is said to be used by many Bell inspectors for testing purposes. From all accounts, the granular carbon transmitter just patented by the National Telephone Manufacturing Company, Boston, seems to be fully equal to the solid back, an instrument entirely unknown to many parts of our country. Indeed, testimony is not wanting that places this National transmitter at the front, it being in use by the Pennsylvania Company, Philadelphia Traction Company, Delaware and Hudson Canal Company and many other large corporations. The transmitter is very simple and combines the sensitiveness of a "Blake" with the power of the most improved "Bell" long-distance telephone, and is destined to be used in connection with submarine cables, electric light or trolley wires, where a powerful instrument of extremely low resistance is imperatively necessary.

We congratulate the National company upon its success in the telephone field. While it has been somewhat exacting in requiring prompt payment for its productions, its customers have been able to rely upon the efficiency of their purchases, and will doubtless turn with favor to its latest production—the "Pony National."

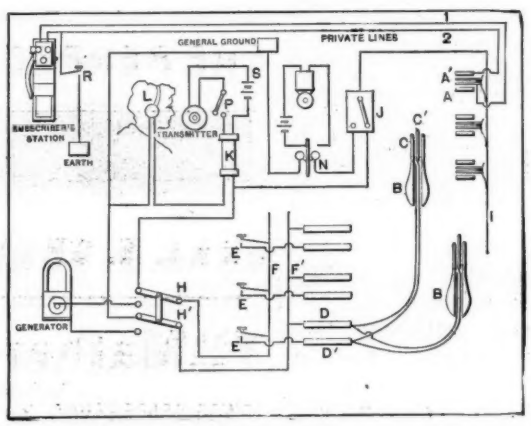


DIAGRAM OF NATIONAL TELEPHONE MANUFACTURING COMPANY'S SYSTEM.

OBITUARY.

Warren Ladd, aged 81 years, died at his home in New Bedford, Mass., on February 20. He was president of the New Bedford and Fairhaven Street Railway Company from 1877 to 1887, when he retired from business.

John P. Zane, aged 69 years, died at his home in Bradford, Pa., on February 23. Mr. Zane received the first charter for a street railway granted by the California Legislature, and built the first street railway in San Francisco.

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PROPOSALS INVITED.

WATER WORKS, CUTHBERT, GA.—Board of Water and Electric Light Commissioners, City of Cuthbert, are inviting sealed proposals for complete system water works, March 19, specifications being furnished by the Mayor upon application. Plans can be seen in Mayor's office in Cuthbert, or engineer's office, Mable & Sullivan, Gould building, Atlanta, Ga.

ELECTRIC LIGHTS, CUTHBERT, GA.—Requests are being made by several firms and individuals of the Mayor and Council of Cuthbert for a franchise and contract to put in an electric light plant of both arc and incandescent lights. Council have deferred active operations in putting in the plant, although $10,000 in bonds have been favorably voted, pending propositions on the franchise plan. If it can be made to interest of city to adopt this, they will do so, otherwise later on in the year they will put in their own plant and operate it.

R. L. MOYE, Mayor.
Cuthbert, Ga., March 1, 1895.

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KINDRED INTERESTS

The Interior Conduit and Insulation Company announces that after March 15 the company's general offices will be located at its works, 527 to 531 West Thirty-fourth street, New York city.

Habirshaw red, white and blue core insulated wires and cables are gently brought to mind by a neat pocket memorandum book prepared for his friends by J. W. Godfrey, manager of sales, 15 Cortlandt street, New York city.

W. L. McCarty, 353 Broadway, New York city, freight and passenger agent for the Florida Central and Peninsula Railroad is sending out a very neat pamphlet giving a list of hunting, fishing and tourist resorts in Florida reached by this road.

The Penberthy Injector Company, of Detroit, Mich., report that their new line of water gauges, oil cups, etc., is meeting with so great a success that they are several weeks behind their orders, and have been compelled to increase their force by putting on 10 additional men since the 1st of January, and expect to make another increase in working force of about the same number in a few weeks.

It is conceded by all wheelmen that some lubricant is needed to prevent wear of chain and sprocket wheel; such a lubricant not only prevents wear, but very largely increases speed and ease of driving. Oil or grease, while useful for the moment, catches and holds dust and dirt. After much experimenting it has been found that graphite makes the most perfect lubricant, when the right kind is used and properly prepared. The word graphite, like the word charity, covers a multitude of sins. Under the name of graphite lubricant are found compounds of cheap blacklead, stove polish, foundry facings, soapstone, etc. Safety in buying, and the surety of getting the best graphite lubricant made, lie in purchasing of a firm of world wide reputation and long experience. Such a firm is the Joseph Dixon Crucible Company, of Jersey City, N. J. They have mined and manipulated graphite for nearly 70 years, and when called upon by leading wheelmen to furnish a cycle lubricant that would meet the fullest requirements of the cycler, they first purchased samples of all the chain lubricants in the market and analyzed them, and then selected from their choicest stocks of graphite a brand of graphite of unequaled smoothness, and produced a stick, or solid lubricant, which will not gum or hold dirt and dust, but which will so thoroughly lubricate the chain and sprockets that the wear will be reduced to the slightest degree, and ease of riding and speed greatly increased.

The Mather Electric Company, of Manchester, Conn., report a continuation of new business secured. The following sales have recently been made through their isolated lighting plant department:

The Berlin Iron Bridge Company, East Berlin, Conn., second order, 250 light ring type dynamo; Perkins Electric Switch Manufacturing Company, Hartford, Conn., 350 light ring type dynamo; Haverhill Paper Company, Bradford, Mass., 150 light ring type dynamo; Inter-Mountain Electric Company, Pocatello, Idaho, 450 light ring type dynamo; Hub Gore Makers, Brockton, Mass., 450 light ring type dynamo; Coffee Exchange, New York City, 600 light ring type dynamo; Iroquois Furnace Company, 150 light ring type dynamo; Cranston Worsted Mills, Bristol, R.I., 250 light ring type dynamo; New Opera House, Holyoke, Mass., 250 light ring type dynamo; Hub Gore Makers, Camden, N. J., 150 light ring type dynamo; Waverly Woolen Company, Pittsfield, Maine, 350 light ring type dynamo, second order; Thatcher Bros., New Bedford, Mass., 100 light ring type dynamo; James F. Grant, Youngstown, Ohio. 450 light ring type dynamo; Rockwell Manufacturing Company, Milwaukee, Wis. 100 light ring type dynamo, second order; Burtis & Howard, Minneapolis, Minn., 100 light ring type dynamo, third order; S. N. Blake, Elmira, N. Y., two 250 light ring type dynamos; B. Lowenstein & Bros., Memphis, Tenn., 100 light ring type dynamo; Straight Line Engine Company, Straight Line, New York, 20 kilowatt Manchester type generator; Cook Locomotive Works, Paterson, N. J., 45 kilowatt 220 volt multipolar generator; J. Holt Gates, Chicago, Ills., two 60 kilowatt multipolar generators, 500 volts. Denison Light and Power Company, Denison, Texas, 45 kilowatt multipolar generators, 220 volts.

The Development of German Telephony.

The following appears in the *Elektrotechnische Anzeiger*, January 25, 1895:

During the past year the long-distance telephone service of the Empire has assumed vast proportions. The last few months have witnessed the inter-connection of Berlin, München, Frankfort-on-the-Main and Kassel. The telephonic traffic between Berlin and Hamburg has grown so rapidly that a third loop has been added. At present 250 cities are in direct connection with the metropolis. While up to the present our longest telephone line did not exceed 700 kilometres (434 miles), the recently completed trunk, December 24, 1894, between Berlin and Memel *via* Posen, Thorn, Danzig, Elbing, Insterburg, Berlin, is fully 1,000 kilometres (620 miles). All technical difficulties in the construction of lines and apparatus have been overcome, and the only obstacle to the still more rapid growth of telephonic service lies in the rather limited number of exchanges which can be included in long trunk lines. The Postal Department is not only constantly increasing city exchange facilities, but also interurban lines in the various "industrial districts." Only a short time ago, the following large cities have been inter-connected: Cologne-Hamburg; Strassburg-Kolmar-Mühlhausen (Elsass).

A line is being built between Koblenz and Bingen. There are at present 100,000 telephone stations in the territory of the Postal Department. Among the important exchanges there are: Berlin with 22,700 subscribers (equal to the total number of telephone subscribers in France); Hamburg with 900 telephone subscribers; Dresden, 3,267; Leipzig, 3,290; Cologne, 2,711; Frankfort, on-the-Main, 2,674; Breslau, 2,204.

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